

SPECIAL
REPORT AND
FREE MAP

AFGHANISTAN

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NATIONAL GEOGRAPHIC

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ABRAHAM

FATHER OF THREE FAITHS

AFGHANISTAN

Land in Crisis

Produced by National Geographic Maps for National Geographic Magazine



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JOHN M. FAHEY, JR., PRESIDENT AND CEO
WILLIAM L. ALLEN, EDITOR IN CHIEF
NATIONAL GEOGRAPHIC MAGAZINE
ALLEN CARROLL, CHIEF CARTOGRAPHER
Washington, D.C., December 2001

Twenty-three years of fighting have left Afghanistan in misery and ruins. Once proud cities, such as 3,000-year-old Herat, have been bombed into rubble. Villagers have been slaughtered, irrigation systems wrecked, fruit orchards chopped down, and wheat fields planted with land mines. At least 1.5 million Afghans were killed during the war against the Soviets from 1979 to 1989 and in civil war since. Another 3.5 million remain refugees in Pakistan and Iran. Famine stalks the countryside, while widows in the capital city of Kabul beg in the streets.

The Afghans are a tough people. Their defiant spirit was forged in the rugged Hindu Kush mountains that sweep across the heart of the country, as well as in isolated valleys and on desert plateaus. Their rich culture—a mosaic of Persian and Central Asian traditions—has been passed down from generation to generation since at least the time of Cyrus the Great in the fourth century B.C. But they are in deep trouble now.

One in four Afghan children will die before the age of five. Life expectancy for men and women has fallen to age 46. There is little or no electricity, safe water is hard to find, and health services are scarce. Fewer than a third of all Afghans are literate. Relief agencies warn that a fourth of the population remains at risk of death from war, hunger, or poverty. "They have finally hit rock bottom," the United Nations reported late this year.

When the Taliban militia took control of most of Afghanistan in 1996, ending years of fighting among rival warlords and ethnic factions, the fundamentalist movement promised to restore order, disarm the population, and enforce Islamic law. In its zeal to turn back the clock to its own vision of the seventh century, the Taliban focused more on enforcing its puritanical interpretation of Islam—executing criminals in soccer stadiums, evicting girls from schools, banning women from work places, outlawing music, and forcing men to wear beards—than on dealing with famine, refugees, or public health. By harboring suspected terrorist Osama bin Laden even after the September 11 attacks on New York and Washington, the Taliban further isolated the country from the rest of the world, leaving the door open to the regime's downfall.

Afghanistan has never been an easy place to live. Today it is a country on the brink of chaos.

Stratching from eastern Iran to western India, this dramatic view was assembled from images made by a polar-orbiting satellite 600 miles above the Earth. Taken during spring and summer, the images were merged with topographic data to reveal a relief of mountains, deserts, and valleys.

Conflict and Intrigue Plague a Nation

1838-42 First Anglo-Afghan war. British invade to thwart Afghan incursion into British India. British forces massacred.

1878 Second British invasion of Afghan territory to counter Russian expansion.

1879 Afghan and British sign the treaty of Gandamak. Afghan Amir Abdur Rahman Khan given authority over internal affairs, but Britain retains control of international policy.

1893-95 Durand Line dividing Afghanistan and British India confirmed. The border splits the Pashtun ethnic group, leaving half in what is now Pakistan.

1919 Third Anglo-Afghan war. Afghan army attacks British troops in India. By treaty Britain gives up interest in Afghanistan, making it a fully independent state.

1932 Zahir Shah begins a 40-year reign as king.

1961-63 Pakistan closes its Afghan border to discourage Pashtun efforts toward political reunification with their tribe in Afghanistan.

1973 Mohammed Daoud seizes power in a coup and declares Afghanistan a republic. His reforms alienate left-wing factions.

1974 Taraki is replaced as prime minister by Hafizullah Amin. Amin is killed in a coup backed by Soviet troops, who install Babrak Karmal. Rebel mujahidin (holy warriors) explode into full-scale guerrilla war.

1979 Fighting by mujahidin escalates. U.S., Pakistan, China, Egypt, Iran, and Saudi Arabia funnel money and arms to rebels.

1980 Several rebel groups join to fight Soviets. Many Afghan civilians flee their homes.

1984 Daoud resigns as prime minister, following border disputes with Pakistan.

1986 Constitution adopted providing for democratic government, but King Zahir Shah and legislature fail to agree on reforms.

1988 Last Soviet soldier leaves Afghanistan. Mujahidin continue to fight Najibullah.

1992 Najibullah replaces Karmal as head of government. U.S. arms mujahidin with Stinger missiles to shoot down Soviet helicopter gunships.

1993 Afghanistan and Pakistan, with the U.S.S.R. and U.S., sign peace accord. Soviet troops begin to withdraw.

1994 Rabbani's power struggle with prime minister Gulbuddin Hekmatyar rekindles civil war. The Taliban captures Kandahar.

1996 Taliban deposes Rabbani, exiles Najibullah, and seizes control of Kabul, imposing a strict Islamic regime.

1998 Taliban destroys two giant statues of Buddha at Bamian dating from third and fifth centuries, calling them an affront to Islam.

2001 Three weeks after the September 11 attacks on New York and Washington, the United States and Britain rain bombs and missiles down on Afghanistan, targeting both bin Laden's training camps and the Taliban regime that harbors the suspected terrorist.

2001 On September 9 suicide bombers fatally wound anti-Taliban resistance leader Ahmad Shah Massoud.

2001 Major earthquake hits northeast Afghanistan. U.S. missile strikes directed at training camps of Osama bin Laden in the Khost province in retaliation for attacks upon U.S. embassies in Africa.

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UZBEKISTAN

REPUBLIC OF UZBEKISTAN

To aid the United States military effort against the Taliban, Uzbekistan became the first former Soviet republic in Central Asia to allow U.S. troops and aircraft on its soil.

AREA: 172,589 sq mi (447,007 sq km)

POPULATION: 28.2 million

RELIGION: Muslim 89%, Eastern Orthodox 9%

LANGUAGE: Uzbek, Russian, Tajik

LITERACY: 99%

LIFE EXPECTANCY: 64 years

GDP PER CAPITA: \$5,450

TROOPS: 74,000

TURKMENISTAN

TURKMENISTAN

President Saparmurat Niyazov runs a Soviet-style regime in this desert nation that has vast natural gas reserves but inadequate pipelines.

AREA: 148,119 sq mi (386,000 sq km)

POPULATION: 4.8 million

RELIGION: Muslim 89%, Eastern Orthodox 9%

LANGUAGE: Turkmen, Russian, Uzbek

LITERACY: 98%

LIFE EXPECTANCY: 67 years

GDP PER CAPITA: \$5,300

TROOPS: 16,000

AFGHANISTAN

ISLAMIC STATE OF AFGHANISTAN

Following U.S. attacks on the Taliban in October, the Northern Alliance opposition, also known as the United Front, began to plan a new government. Most nations never recognized the Taliban regime, and the UN has continued to fly the flag established by the former government and adopted by the Northern Alliance.

AREA: 261,773 sq mi (680,289 sq km)

POPULATION: 48.8 million

RELIGION: Sunni Muslim 84%, Shia Muslim 15%

LANGUAGE: Pashto, Dari, Turkic languages

LITERACY: 20%

LIFE EXPECTANCY: 46 years

GDP PER CAPITA: \$1,800

TROOPS: No national military forces; 200,000-250,000 Northern Alliance/United Front forces; 120,000-180,000

TAJIKISTAN

REPUBLIC OF TAJIKISTAN

Poorest of the former Soviet republics in Central Asia, Tajikistan relies upon 25,000 Russian troops to guard its Afghan border.

AREA: 141,712 sq mi (367,007 sq km)

POPULATION: 6.5 million

RELIGION: Sunni Muslim 80%, Shia Muslim 15%

LANGUAGE: Tajik, Russian

LITERACY: 99%

LIFE EXPECTANCY: 64 years

GDP PER CAPITA: \$5,140

TROOPS: 17,000

TURKMENISTAN

TURKMENISTAN

President Saparmurat Niyazov runs a Soviet-style regime in this desert nation that has vast natural gas reserves but inadequate pipelines.

AREA: 148,119 sq mi (386,000 sq km)

POPULATION: 4.8 million

RELIGION: Muslim 89%, Eastern Orthodox 9%

LANGUAGE: Turkmen, Russian, Uzbek

LITERACY: 98%

LIFE EXPECTANCY: 67 years

GDP PER CAPITA: \$5,300

TROOPS: 16,000

IRAN

ISLAMIC REPUBLIC OF IRAN

Iran's Shiite Islamic government nearly went to war in 1998 when the Taliban's Sunni forces killed Iranian diplomats in Mazar-e Sharif.

AREA: 1,648,195 sq mi (4,249,893 sq km)

POPULATION: 66.1 million

RELIGION: Shiite Muslim 89%, Sunni Muslim 10%

LANGUAGE: Persian, Turkish languages, Kurdish, etc.

LITERACY: 72%

LIFE EXPECTANCY: 70 years

GDP PER CAPITA: \$6,300

TROOPS: 143,000

PAKISTAN

ISLAMIC REPUBLIC OF PAKISTAN

When General Musharraf aided military action in Afghanistan, the U.S. lifted sanctions imposed after Pakistan's nuclear tests in 1998.

AREA: 307,374 sq mi (796,000 sq km)

POPULATION: 144.6 million

RELIGION: Sunni Muslim 77%, Shia Muslim 20%

LANGUAGE: Pashto, Sindhi, Punjabi, Urdu, English

LITERACY: 47%

LIFE EXPECTANCY: 61 years

GDP PER CAPITA: \$5,200

TROOPS: 587,000

AFGHANISTAN AND PAKISTAN

Produced by National Geographic Maps for National Geographic Magazine

NATIONAL GEOGRAPHIC

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Washington, D.C., December 2001

Wedged between the Middle East and the rest of Asia, Afghanistan stands at the crossroads of ancient trade and invasion routes. In the fourth century B.C., Alexander the Great crossed its rugged mountains, followed centuries later by Persian, Arab, and Mongol conquerors. The modern Afghan state was created in 1747, when Ahmad Shah Durrani, a

Pashtun leader, consolidated rival Afghan tribes. During the late 19th century Russia and Great Britain competed for control of Afghanistan in a geopolitical struggle known as the Great Game. Today demand for Central Asia's untapped oil and gas reserves has started what some are calling a new Great Game among energy-hungry world powers.

After taking power in 1996, Afghanistan's defiant Taliban movement alienated the country from every neighboring nation but Pakistan—until even Pakistani leaders gave up on the ultraconservative Islamic regime next door. During the Soviet occupation of Afghanistan in the 1980s, Pakistan served as a base for Afghan *mujahidin* resistance fighters, welcomed millions of Afghan refugees, and later sponsored the Taliban in its rise to power over rival factions. But the relationship cooled after Taliban leaders rebuffed Pakistani policies and Taliban-style fundamentalists inside Pakistan threatened to disrupt that nation's complex Islamic society, the population of which is more than five times as large as Afghanistan's.

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THE COVER

Rembrandt's "Sacrifice of Isaac" reveals the artist's Judeo-Christian heritage: Muslims believe it was Ishmael that Abraham was to sacrifice—and forbid depictions of the prophets.

BY GIRAUDON/ART
RESOURCE, NEW YORK

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joy



HOT!
HOT!
HOT!



The Explorer. Our high-tech pack mule.



[Jack bringing me more water.]

Going below sea level without scuba gear!

Our annual trip from L.A. to Lake Mead. Always tore through the desert. Not this time.

Decided to do Death Valley. Taking the Explorer deep. Drove up these major ridges, then down onto the Valley floor. Scary-hot, but amazingly beautiful!

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Rattlesnake
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RICKS CLIPBOARD

Motor Trend 06/01
The '02 Explorer's ace in the hole is its new suspension setup. Not only does it offer ride and handling light years ahead of the



2002 FORD EXPLORER HANDLING AND SUSPENSION Independent Rear Suspension Testing Conducted January-March 2001

OBJECTIVE:

Use computer modeling to design world-class driving dynamics for the 2002 Ford Explorer. 1,000 suspension setups initiated and tested.

Rick - our final suspension ruled at the proving grounds. 250 passes on Power Hop Hill. 3000 through Twist Ditch. Best Explorer stuff we've had in Yucca.
- Doug



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26 / 90



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JAMES L. STANFIELD

“It is said that there are really only three sorts of people: the mowers of lawns, the well poisoners, and the life enhancers. Tad was a life enhancer of the first rank.” That’s how one friend began his eulogy to Tadeusz Witold Szulc, who died of cancer on May 21 at the age of 74. Tad Szulc was a born reporter. He worked in more than 90 countries, including Bhutan, where he visited an astrological institute (above). He satisfied his limitless curiosity about the world as a *New York Times* correspondent and as the author of 20 books (among them a biography of Pope John Paul II) and numerous magazine articles. The first of Tad’s six NATIONAL GEOGRAPHIC stories, “Poland: The Hope That Never Dies,” appeared in January 1988.

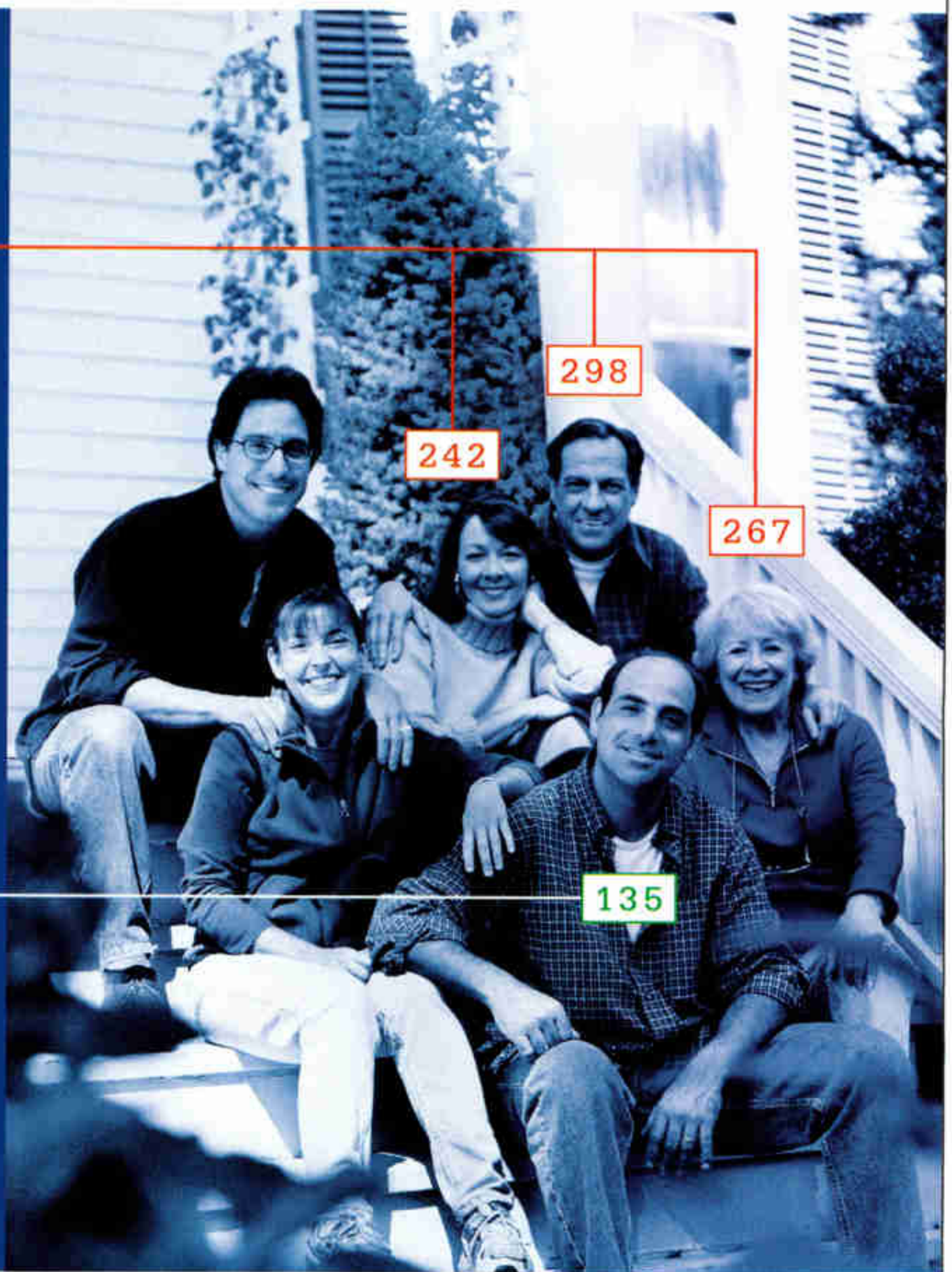
His investigation into Abraham, patriarch of the three great monotheistic religions, is his final contribution to print. Marianne, Tad’s wife of 52 years, knows better than anyone how much the story meant to him. “He was very much emotionally caught up in it,” she said. “He worked on it right up till his death. It was very, very important to him.”

The story of Abraham is important to the world, for the message of Abraham is one of peace and hope. At a time of escalating violence and terrorism (the Geographic family lost two of our own in the September 11 attacks), I hope that our search for Abraham and his meaning might bring Jews, Muslims, and Christians everywhere closer together. Abraham as life enhancer—that would have appealed to Tad.

Bill Allen

Family history
of high cholesterol.

Rewriting history.



Important information:

LIPITOR (atorvastatin calcium) is a prescription drug used with diet to lower cholesterol. LIPITOR is not for everyone, including those with liver disease or possible liver problems, women who are nursing, pregnant, or may become pregnant. LIPITOR has not been shown to prevent heart disease or heart attacks.

If you take LIPITOR, tell your doctor about any unusual muscle pain or weakness. This could be a sign of serious side effects. It is important to tell your doctor about any medications you are currently taking to avoid possible serious drug interactions. Your doctor may do simple blood tests to monitor liver function before and during drug treatment. Most commonly reported side effects are gas, constipation, stomach pain and indigestion. They are usually mild and tend to go away.

Please see additional important information on next page.

The bad news: high cholesterol often has as much to do with family genes as food. The good news: if diet and exercise aren't enough, adding LIPITOR® can lower your total cholesterol 29% to 45% and your bad cholesterol 39% to 60%. So shake up your tree a little. One in five people has high cholesterol and millions need treatment including diet and possibly medication — talk to your doctor to find out if LIPITOR is right for you. To learn more, contact us at 1-888-LIPITOR or www.lipitor.com.

LIPITOR
atorvastatin calcium
tablets

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LIPITOR® (Atorvastatin Calcium) Tablets
Brief Summary of Prescribing Information

CONTRAINDICATIONS: Active liver disease or unexplained persistent elevations of serum transaminases. Hypersensitivity to any component of this medication. **Pregnancy and Lactation** — Atherosclerosis is a chronic process and discontinuation of lipid-lowering drugs during pregnancy should have little impact on the outcome of long-term therapy of primary hypercholesterolemia. Cholesterol and other products of cholesterol biosynthesis are essential components for fetal development (including synthesis of steroids and cell membranes). Since HMG-CoA reductase inhibitors decrease cholesterol synthesis and possibly the synthesis of other biologically active substances derived from cholesterol, they may cause fetal harm when administered to pregnant women. Therefore, HMG-CoA reductase inhibitors are contraindicated during pregnancy and in nursing mothers. **ATORVASTATIN SHOULD BE ADMINISTERED TO WOMEN OF CHILDBEARING AGE ONLY WHEN SUCH PATIENTS ARE HIGHLY UNLIKELY TO CONCEIVE AND HAVE BEEN INFORMED OF THE POTENTIAL HAZARDS.** If the patient becomes pregnant while taking this drug, therapy should be discontinued and the patient apprised of the potential hazard to the fetus.

WARNINGS: Liver Dysfunction — HMG-CoA reductase inhibitors, like some other lipid-lowering therapies, have been associated with biochemical abnormalities of liver function. **Persistent elevations (>3 times the upper limit of normal [ULN]) occurring on 2 or more occasions) in serum transaminases occurred in 0.7% of patients who received atorvastatin in clinical trials. The incidence of these abnormalities was 0.2%, 0.2%, 0.6%, and 2.3% for 10, 20, 40, and 80 mg, respectively.** One patient in clinical trials developed jaundice. Increases in liver function tests (LFT) in other patients were not associated with jaundice or other clinical signs or symptoms. Upon dose reduction, drug interruption, or discontinuation, transaminase levels returned to or near pretreatment levels without sequelae. Eighteen of 30 patients with persistent LFT elevations continued treatment with a reduced dose of atorvastatin. **It is recommended that liver function tests be performed prior to and at 12 weeks following both the initiation of therapy and any elevation of dose, and periodically (eg, semiannually) thereafter.** Liver enzyme changes generally occur in the first 3 months of treatment with atorvastatin. Patients who develop increased transaminase levels should be monitored until the abnormalities resolve. Should an increase in ALT or AST of >3 times ULN persist, reduction of dose or withdrawal of atorvastatin is recommended. Atorvastatin should be used with caution in patients who consume substantial quantities of alcohol and/or have a history of liver disease. Active liver disease or unexplained persistent transaminase elevations are contraindications to the use of atorvastatin (see CONTRAINDICATIONS). **Skeletal Muscle** — **Rhabdomyolysis with acute renal failure secondary to myoglobinuria has been reported with other drugs in this class.** Uncomplicated myalgia has been reported in atorvastatin-treated patients (see ADVERSE REACTIONS). Myopathy, defined as muscle aches or muscle weakness in conjunction with increases in creatine phosphokinase (CPK) values >10 times ULN, should be considered in any patient with diffuse myalgias, muscle tenderness or weakness, and/or marked elevation of CPK. Patients should be advised to report promptly unexplained muscle pain, tenderness or weakness, particularly if accompanied by malaise or fever. Atorvastatin therapy should be discontinued if markedly elevated CPK levels occur or myopathy is diagnosed or suspected. The risk of myopathy during treatment with other drugs in this class is increased with concurrent administration of cyclosporine, fibric acid derivatives, erythromycin, niacin, or azole antifungals. Physicians considering combined therapy with atorvastatin and fibric acid derivatives, erythromycin, immunosuppressive drugs, azole antifungals, or lipid-lowering doses of niacin should carefully weigh the potential benefits and risks and should carefully monitor patients for any signs or symptoms of muscle pain, tenderness, or weakness, particularly during the initial months of therapy and during any periods of upward dosage titration of either drug. Periodic creatine phosphokinase (CPK) determinations may be considered in such situations, but there is no assurance that such monitoring will prevent the occurrence of severe myopathy. **Atorvastatin therapy should be temporarily withheld or discontinued in any patient with an acute, serious condition suggestive of a myopathy or having a risk factor predisposing to the development of renal failure secondary to rhabdomyolysis (eg, severe acute infection, hypotension, major surgery, trauma, severe metabolic, endocrine and electrolyte disorders, and uncontrolled seizures).**

PRECAUTIONS: General — Before instituting therapy with atorvastatin, an attempt should be made to control hypercholesterolemia with appropriate diet, exercise, and weight reduction in obese patients, and to treat other underlying medical problems (see INDICATIONS AND USAGE in full prescribing information). **Information for Patients** — Patients should be advised to report promptly unexplained muscle pain, tenderness, or weakness, particularly if accompanied by malaise or fever. **Drug Interactions** — The risk of myopathy during treatment with other drugs of this class is increased with concurrent administration of cyclosporine, fibric acid derivatives, niacin (nicotinic acid), erythromycin, azole antifungals (see WARNINGS, Skeletal Muscle). **Antacid:** When atorvastatin and Maalox® TC suspension were coadministered, plasma concentrations of atorvastatin decreased approximately 35%. However, LDL-C reduction was not altered. **Antipyrine:** Because atorvastatin does not affect the pharmacokinetics of antipyrine, interactions with other drugs metabolized via the same cytochrome isozymes are not expected. **Colestipol:** Plasma concentrations of atorvastatin decreased approximately 25% when colestipol and atorvastatin were coadministered. However, LDL-C reduction was greater when atorvastatin and colestipol were coadministered than when either drug was given alone. **Cimetidine:** Atorvastatin plasma concentrations and LDL-C reduction were not altered by coadministration of cimetidine. **Digoxin:** When multiple doses of atorvastatin and digoxin were coadministered, steady-state plasma digoxin concentrations increased by approximately 20%. Patients taking digoxin should be monitored appropriately. **Erythromycin:** In healthy individuals, plasma concentrations of atorvastatin increased approximately 40% with coadministration of atorvastatin and erythromycin, a known inhibitor of cytochrome P450 3A4 (see WARNINGS, Skeletal Muscle). **Oral Contraceptives:** Coadministration of atorvastatin and an oral contraceptive increased AUC values for norethindrone and ethinyl estradiol by approximately 30% and 20%. These increases should be considered when selecting an oral contraceptive for a woman taking atorvastatin. **Warfarin:** Atorvastatin had no clinically significant effect on prothrombin time when administered to patients receiving chronic warfarin treatment. **Endocrine Function** — HMG-CoA reductase inhibitors interfere with cholesterol synthesis and theoretically might blunt adrenal and/or gonadal steroid production. Clinical studies have shown that atorvastatin does not reduce basal plasma cortisol concentration or impair adrenal reserve. The effects of HMG-CoA reductase inhibitors on male fertility have not been studied in adequate numbers of patients. The effects, if any, on the pituitary-gonadal axis in premenopausal women are unknown. Caution should be exercised if an HMG-CoA reductase inhibitor is administered concomitantly with drugs that may decrease the levels or activity of endogenous steroid hormones, such as ketoconazole, spironolactone, and cimetidine. **CNS Toxicity** — Brain hemorrhage was seen in a female dog treated for 3 months at 120 mg/kg/day. Brain hemorrhage and optic nerve vacuolation were seen in another female dog that was sacrificed in moribund condition after 11 weeks of escalating doses up to 280 mg/kg/day. The 120 mg/kg dose resulted in a systemic exposure approximately 16 times the human plasma area-under-the-curve (AUC, 0-24 hours) based on the maximum human dose of 80 mg/day. A single tonic convulsion was seen in each of 2 male dogs (one treated at 10 mg/kg/day and one at 120 mg/kg/day) in a 2-year study. No CNS lesions have been observed in mice after chronic treatment for up to 2 years at doses up to 400 mg/kg/day or in rats at doses up to 100 mg/kg/day. These doses were 6 to 11 times (mouse) and 8 to 16 times (rat) the human AUC (0-24) based on the maximum recommended human dose of 80 mg/day. CNS vascular lesions, characterized by perivascular hemorrhages, edema, and mononuclear cell infiltration of perivascular spaces, have been observed in dogs treated with other members of this class. A chemically similar drug in this class produced optic nerve degeneration (Wallerian degeneration of retinogeniculate fibers) in clinically normal dogs in a dose-dependent fashion at a dose that produced plasma drug levels about 30 times higher than the mean drug level in humans taking the highest recommended dose. **Carcinogenesis, Mutagenesis, Impairment of Fertility** — In a 2-year carcinogenicity study in rats at dose levels of 10, 30, and 100 mg/kg/day, 2 rare tumors were found in muscle in high-dose females: in one, there was a rhabdomyosarcoma and, in another, there was a fibrosarcoma. This dose represents a plasma AUC (0-24) value of approximately 16 times the mean human plasma drug exposure after an 80 mg oral dose. A 2-year carcinogenicity study in mice given 100, 200, or 400 mg/kg/day resulted in a significant increase in liver adenomas in high-dose males and liver carcinomas in high-dose females. These findings occurred at plasma AUC (0-24) values of approximately 6 times the mean human plasma drug exposure after an 80 mg oral dose. *In vitro*, atorvastatin was not mutagenic or clastogenic in the following tests with and without metabolic activation: the Ames test with *Salmonella typhimurium* and *Escherichia coli*, the HGPRT forward mutation assay in Chinese hamster lung cells, and the chromosomal aberration assay in Chinese hamster lung cells. Atorvastatin was negative in the *in vivo* mouse micronucleus test. Studies in rats performed at doses up to 175 mg/kg (15 times the human exposure)

produced no changes in fertility.

There was aplasia and aspermia in the epididymis of 2 of 10 rats treated with 100 mg/kg/day of atorvastatin for 3 months (16 times the human AUC at the 80 mg dose); testis weights were significantly lower at 30 and 100 mg/kg and epididymal weight was lower at 100 mg/kg. Male rats given 100 mg/kg/day for 11 weeks prior to mating had decreased sperm motility, sperm head concentration, and increased abnormal sperm. Atorvastatin caused no adverse effects on semen parameters, or reproductive organ histopathology in dogs given doses of 10, 40, or 120 mg/kg for two years. **Pregnancy** — **Pregnancy Category X: See CONTRAINDICATIONS.** Safety in pregnant women has not been established. Atorvastatin crosses the rat placenta and reaches a level in fetal liver equivalent to that of maternal plasma. Atorvastatin was not teratogenic in rats at doses up to 300 mg/kg/day or in rabbits at doses up to 100 mg/kg/day. These doses resulted in multiples of about 30 times (rat) or 20 times (rabbit) the human exposure based on surface area (mg/m²). In a study in rats given 20, 100, or 225 mg/kg/day, from gestation day 7 through to lactation day 21 (weaning), there was decreased pup survival at birth, neonate, weaning, and maturity in pups of mothers dosed with 225 mg/kg/day. Body weight was decreased on days 4 and 21 in pups of mothers dosed at 100 mg/kg/day; pup body weight was decreased at birth and at days 4, 21, and 91 at 225 mg/kg/day. Pup development was delayed (rotorod performance at 100 mg/kg/day and acoustic startle at 225 mg/kg/day; pinnae detachment and eye opening at 225 mg/kg/day). These doses correspond to 6 times (100 mg/kg) and 22 times (225 mg/kg) the human AUC at 80 mg/day. Rare reports of congenital anomalies have been received following intrauterine exposure to HMG-CoA reductase inhibitors. There has been one report of severe congenital bony deformity, tracheo-esophageal fistula, and anal atresia (VATER association) in a baby born to a woman who took lovastatin with dextroamphetamine sulfate during the first trimester of pregnancy. LIPITOR should be administered to women of childbearing potential only when such patients are highly unlikely to conceive and have been informed of the potential hazards. If the woman becomes pregnant while taking LIPITOR, it should be discontinued and the patient advised again as to the potential hazards to the fetus. **Nursing Mothers** — Nursing rat pups had plasma and liver drug levels of 50% and 40%, respectively, of that in their mother's milk. Because of the potential for adverse reactions in nursing infants, women taking LIPITOR should not breast-feed (see CONTRAINDICATIONS). **Pediatric Use** — Treatment experience in a pediatric population is limited to doses of LIPITOR up to 80 mg/day for 1 year in 8 patients with homozygous FH. No clinical or biochemical abnormalities were reported in these patients. None of these patients was below 9 years of age. **Geriatric Use** — Treatment experience in adults age ≥70 years with doses of LIPITOR up to 80 mg/day has been evaluated in 221 patients. The safety and efficacy of LIPITOR in this population were similar to those of patients <70 years of age.

ADVERSE REACTIONS: LIPITOR is generally well-tolerated. Adverse reactions have usually been mild and transient. In controlled clinical studies of 2,502 patients, <2% of patients were discontinued due to adverse experiences attributable to atorvastatin. The most frequent adverse events thought to be related to atorvastatin were constipation, flatulence, dyspepsia, and abdominal pain. **Clinical Adverse Experiences** — Adverse experiences reported in ≥2% of patients in placebo-controlled clinical studies of atorvastatin, regardless of causality assessment, are shown in the following table.

Adverse Events in Placebo-Controlled Studies (% of Patients)					
BODY SYSTEM Adverse Event	Placebo	Atorvastatin 10 mg	Atorvastatin 20 mg	Atorvastatin 40 mg	Atorvastatin 80 mg
	N = 270	N = 863	N = 36	N = 79	N = 94
BODY AS A WHOLE					
Infection	10.0	10.3	2.8	10.1	7.4
Headache	7.0	5.4	16.7	2.5	6.4
Accidental Injury	3.7	4.2	0.0	1.3	3.2
Flu Syndrome	1.9	2.2	0.0	2.5	3.2
Abdominal Pain	0.7	2.8	0.0	3.8	2.1
Back Pain	3.0	2.8	0.0	3.8	1.1
Allergic Reaction	2.6	0.9	2.8	1.3	0.0
Asthenia	1.9	2.2	0.0	3.8	0.0
DIGESTIVE SYSTEM					
Constipation	1.8	2.1	0.0	2.5	1.1
Diarrhea	1.5	2.7	0.0	3.8	5.3
Dyspepsia	4.1	2.3	2.8	1.3	2.1
Flatulence	3.3	2.1	2.8	1.3	1.1
RESPIRATORY SYSTEM					
Sinusitis	2.6	2.8	0.0	2.5	6.4
Pharyngitis	1.5	2.5	0.0	1.3	2.1
SKIN AND APPENDAGES					
Rash	0.7	3.9	2.8	3.8	1.1
MUSCULOSKELETAL SYSTEM					
Arthralgia	1.5	2.0	0.0	5.1	0.0
Myalgia	1.1	3.2	5.6	1.3	0.0

The following adverse events were reported, regardless of causality assessment in patients treated with atorvastatin in clinical trials. The events in *italics* occurred in ≥2% of patients and the events in plain type occurred in <2% of patients.

Body as a Whole: Chest pain, face edema, fever, neck rigidity, malaise, photosensitivity reaction, generalized edema. **Digestive System:** Nausea, gastroenteritis, liver function tests abnormal, colitis, vomiting, gastritis, dry mouth, rectal hemorrhage, esophagitis, eructation, glossitis, mouth ulceration, anorexia, increased appetite, stomatitis, biliary pain, cheilitis, duodenal ulcer, dysphagia, enteritis, melena, gum hemorrhage, stomach ulcer, tenesmus, ulcerative stomatitis, hepatitis, pancreatitis, cholestatic jaundice. **Respiratory System:** Bronchitis, rhinitis, pneumonia, dyspnea, asthma, epistaxis. **Nervous System:** Insomnia, dizziness, paresthesia, somnolence, amnesia, abnormal dreams, libido decreased, emotional lability, incoordination, peripheral neuropathy, torticollis, facial paralysis, hyperkinesia, depression, hypesthesia, hypertension. **Musculoskeletal System:** Arthritis, leg cramps, bursitis, tenosynovitis, myasthenia, tendinous contracture, myositis. **Skin and Appendages:** Pruritus, contact dermatitis, alopecia, dry skin, sweating, acne, urticaria, eczema, seborrhea, skin ulcer. **Urogenital System:** Urinary tract infection, urinary frequency, cystitis, hematuria, impotence, dysuria, kidney calculus, nocturia, epididymitis, fibrocystic breast, vaginal hemorrhage, albuminuria, breast enlargement, metrorrhagia, nephritis, urinary incontinence, urinary retention, urinary urgency, abnormal ejaculation, uterine hemorrhage. **Special Senses:** Amblyopia, tinnitus, dry eyes, refraction disorder, eye hemorrhage, deafness, glaucoma, parosmia, taste loss, taste perversion. **Cardiovascular System:** Palpitation, vasodilatation, syncope, migraine, postural hypotension, phlebitis, arrhythmia, angina pectoris, hypertension. **Metabolic and Nutritional Disorders:** Peripheral edema, hyperglycemia, creatine phosphokinase increased, gout, weight gain, hypoglycemia. **Hemic and Lymphatic System:** Eczymosis, anemia, lymphadenopathy, thrombocytopenia, petechia. **Postintroduction Reports** — Adverse events associated with LIPITOR therapy reported since market introduction, that are not listed above, regardless of causality assessment, include the following: anaphylaxis, angioneurotic edema, bullous rashes (including erythema multiforme, Stevens-Johnson syndrome, and toxic epidermal necrolysis), and rhabdomyolysis.

OVERDOSAGE: There is no specific treatment for atorvastatin overdose. In the event of an overdose, the patient should be treated symptomatically, and supportive measures instituted as required. Due to extensive drug binding to plasma proteins, hemodialysis is not expected to significantly enhance atorvastatin clearance.

This summary provides important information about Lipitor. For more information, please ask your doctor, pharmacist or healthcare professional to provide the professional labeling and then discuss it with them.

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August 2001

Our article on public lands that are administered by the Bureau of Land Management hit home for many readers. "Whether it's wildlife, forests, or waterways, humans must stop ravaging the land," one wrote. Concerning some recent land designations, another reader declared, "National monuments should be created by the will of the people as expressed through their congressmen, not by presidential fiat."



Oil Field or Sanctuary?

If there is oil under the 1002 Area, we Americans will face a decision whether to capture that energy. But first we have to find out what, if anything, is actually down there. Without those facts, we can only speculate.

FRANK H. MURKOWSKI
*United States Senator, Alaska
Washington, D.C.*

You provided a wealth of information and presented both sides of the drilling controversy in a fair manner. I was in the Brooks Range last summer. To despoil this treasure for a little bit of oil or even a lot of gas would be a sin.

JAMES C. KEESEY
Tabernash, Colorado

There is a good chance oil people overestimate ANWR's potential. If they explore and find less than a bonanza, the problem is moot. If there is a bonanza, population pressure will force development within a generation. Do we do it now under good controls or

later, possibly under the pressure of a war or other emergency?

MARTIN C. EVERITT
Arvada, Colorado

Several facts were left out of the ANWR article. It was not mentioned that 95 percent of Alaska's North Slope is already open to oil and gas development. It was also not mentioned that the Prudhoe Bay oil development creates more air pollution than Washington, D.C., and that it has averaged something like 400 oil spills a year in recent years.

DELLAS HENKE
Hopkins, Michigan

Deadly Silk

I enjoyed your article about spiders. One day my husband called me to remove a snake from the carport. "There's no hurry," he said dryly. "It's got a spiderweb growing on it." Sure enough, I found a motionless baby garter snake eerily coiled and upright like a cobra as the centerpiece of a spiderweb. But when I went to remove it, I found it was very much alive! It just couldn't pull free from the web. I brushed it off and released it. I'll bet that spider is still dreaming about the big one that got away.

SHARI PRANGE
Bonny Doon, California

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AMY TOENSING

ZipUSA: Ocean Grove, NJ

The town is no longer a “quaint” little seaside village. It has become an unaffordable hot spot for the wealthy and elite of Manhattan. My family has over a hundred years of history in this small town and now is being forced to move for reasons of expense, overcrowding, and discomfort with the new influx of weekend and summertime

vacation-spot buyers. God and country no longer rate here against profit and greed. Ocean Grove has become a tourist trap. The only thing missing is a water-slide park and miniature golf. You may have captured a soon-to-be-extinct creature.

MARK GARDNER
Ocean Grove, New Jersey

When my parents took my brother and me to Ocean Grove for a week’s vacation in the 1930s, not only was swimming in the ocean prohibited on Sundays, but on weekdays we had to rent a bathhouse and change into our bathing suits there. And the men’s and boys’ bathing suits had to have tops. Being made of wool, they were scratchy as all get-out. For

some changes I am extremely grateful.

PAUL N. MARSTELLER
Alexandria, Pennsylvania

Reading the article was like opening a bottle of sweet, old perfume. I spent summers in Ocean Grove as a little girl. In a rush I recalled the tang of a crème de menthe parfait in its tall crystal glass; the sound of hundreds of voices lifted in a rousing rendition of “Red River Valley” under a pavilion; the long, slow strolls along the promenade with its Victorian hotels, deciding along with my cousin which ones I wanted to own when I grew up; and the red moon over the midnight ocean.

ROSEMARIE KOCH
Philadelphia, Pennsylvania

Public Lands

The urban population believes that all space outside city limits is meant for fun and games and scenic beauty. When they see a beautiful place, they want to get rid of the people who have cared for it for generations. Present-day ranchers realize the value of improving the land. They are the BLM’s best hope for management that will benefit everyone.

STEPHEN H. PERCY
Mountain Home, Idaho

This middle-aged city boy and his dog dipped into the western wilderness using BLM offices as way points on a month-long

drive from Seattle to Washington, D.C. The trust placed in me as a visitor to these defenseless and remote lands made me feel personally responsible for their well-being. I was amazed at the lack of vandalism and trash at the BLM areas accessible by car. Your article drove home the idea that total trust instills responsibility. Let’s leave the BLM alone.

RICK LAMB
Washington, D.C.

Geographica

Under “Nations by Any Other Name,” Schweiz for Switzerland is only part of the story. There are three official languages, each with a name for Switzerland: Schweiz in German, Suisse in French, and Svizzera in Italian. In addition, to unite the three languages, it is called Confoederatio Helvetica (CH), which means Swiss Confederation in Latin.

JEAN MILMEISTER
Tuntange, Luxembourg

Final Edit

The photo taken near Steens Mountain reminds me of a hunting trip I took there with my father and two other men. One day, leading my horse with a buck across the saddle, I had to detour around a den of rattlesnakes that spooked the horse. We camped in an abandoned one-room schoolhouse on the desert floor at the base of the mountain. It was 110°F at our camp and near freezing at the top of the cliffs. On the blackboard of the schoolhouse some disgruntled shepherd had left these words: “Goodbye you godforsaken sonofabitch of a country—wind, sand, sagebrush, and coyotes.”

PAUL C. HELMKE
Kensington, Maryland

WRITE TO FORUM

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Photographed by Genlid Cubitt

WILDLIFE AS CANON SEES IT

The pileated gibbon spends most of its life in the trees, and exhibits incredible acrobatic skill. Swinging hand-over-hand with arms twice the length of its body, this small ape can quickly disappear into the forest. It also runs bipedally across the tops of branches, and leaps up to 10 meters from one tree canopy to a lower one. But daily activity is generally quiet, as the family unit eats fruits and leaves, rests, grooms and plays. At dawn, a mated pair performs a haunting duet in which the female sings an extended bubbly trill that can be heard nearly two

kilometers away. The pileated gibbon is threatened by hunting and forest destruction.

As a global corporation committed to social and environmental concerns, we join in worldwide efforts to promote greater awareness of endangered species for the benefit of future generations.



Pileated Gibbon (*Hylobates pileatus*)

Size: Length of head and body, 44-63 cm; no tail

Weight: 5-6 kg

Habitat: Tropical evergreen forests in southeast Thailand, and Cambodia west of the Mekong River

Surviving number: Estimated at 10,000-30,000 in Thailand, unknown in Cambodia

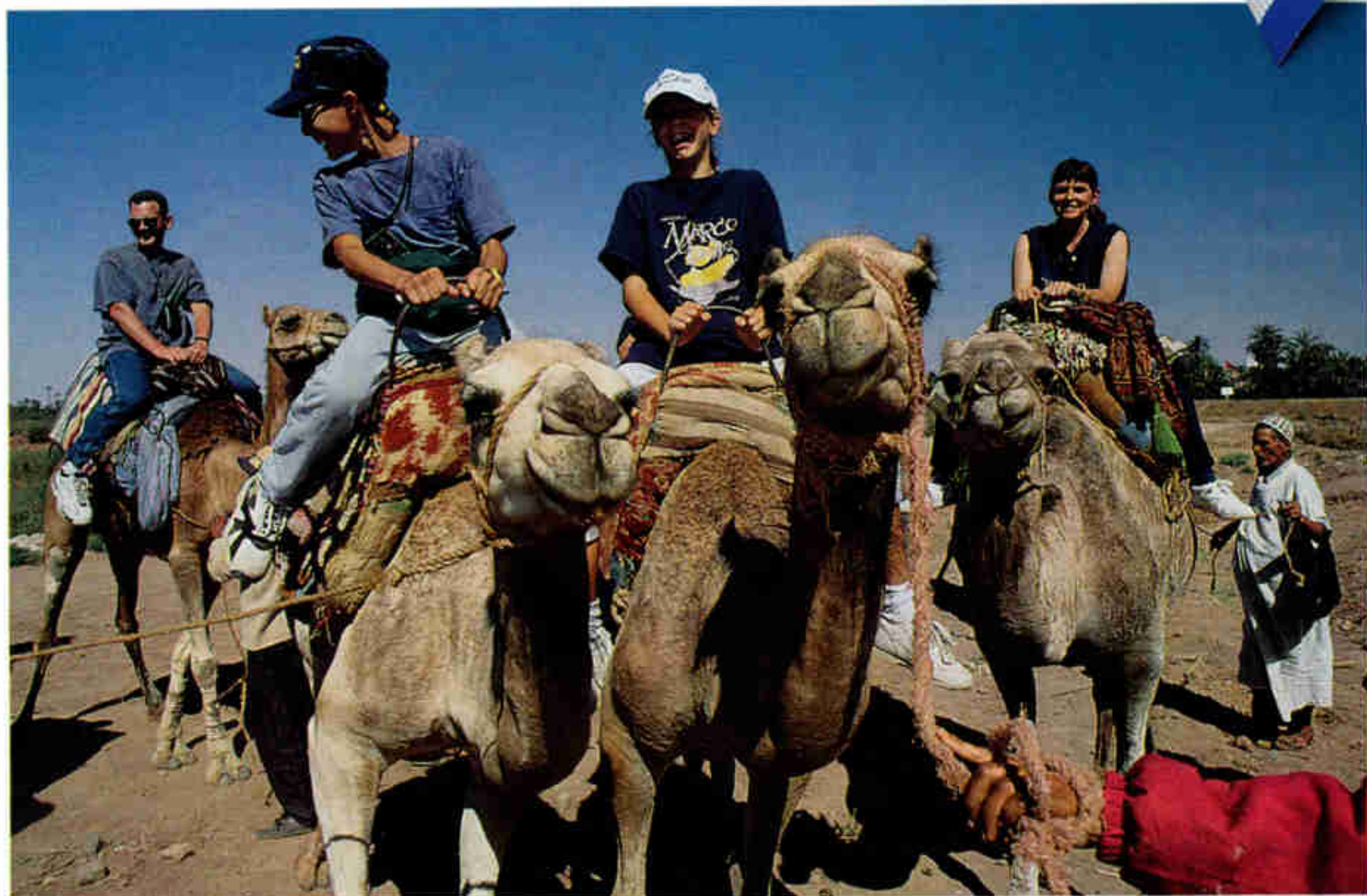
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Watch NATURE on PBS. This program is funded, in part, by Canon.

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A Legacy of Hope



STUDENTS AND TEACHERS EXPLORE MOROCCO BY CAMEL DURING A SOCIETY-SPONSORED EDUCATIONAL TRIP IN 1993. PHOTOGRAPH BY ADAM BUCHANAN

The smiles of children, their eyes bright with curiosity, seem more poignant now than ever as the terror of September continues to reverberate. Along with thousands of Americans, hundreds of citizens from 80 nations perished or were reported missing in the flames and rubble. This was an attack not just on the United States but on the world. And for many people it transformed the world into a sinister place—a place to suspect, to fear, to shut out.

As natural as it might seem to withdraw from the world and turn inward, I think it's exactly the wrong thing to do. That's why the National Geographic Society is reaffirming our mission: To increase exposure to the world and understanding among people of its varied cultures. Our hearts are full of gratitude to our members, who make this urgent work possible. You have enabled us to launch educational programs that have inspired thousands of students and teachers.

Our late colleagues Joe Ferguson and Ann Judge were central to that outreach

(See On Assignment). They took joy in escorting children and teachers into the field for firsthand experiences of the world. Ann and Joe were on just such a trip with three young students and their teachers when the eight of them became victims of the tragic hijackings.

To honor our lost colleagues, the Society's Education Foundation has established a fund to celebrate their lives and their commitment to geography education. All gifts will be matched by the Society to ensure that this work can go on. With greater knowledge of the world, children may come to embrace it, to transform it, and perhaps to bring it peace.

Charitable gifts to the Ferguson/Judge Fund can be made by mailing a check, payable to National Geographic, to: National Geographic Society, Ferguson/Judge Fund, Development Office, 1145 17th Street NW, Washington, DC 20036. To make secure online gifts, go to nationalgeographic.com. Thank you for your ongoing generosity.

DID HE COME FROM ATLANTIS?



ROBERT BALLARD
Underwater Explorer

When he was young, the local pier was his playground. And it sparked a lifelong fascination with the sea. His name is Robert Ballard. He's coaxed secrets from the ocean. Spent 30 years at Woods Hole Oceanographic Institution. Founded the Institute for Exploration and the JASON Project. Discovered ancient shipwrecks. And uncovered the Titanic. Today, he's seeking evidence of a flood of biblical proportions in the Black Sea. 🌿 Dr. Robert Ballard, underwater explorer, and National Geographic explorer-in-residence, is one of Ford Motor Company's Heroes for the Planet. A program that's part of ongoing Ford Motor Company initiatives to underwrite and support efforts that make the world a better place. 🌿 To learn more about Dr. Ballard and other Heroes for the Planet, just visit our website. You'll find fascinating information, including links to his favorite web sites. Around the globe, there are amazing individuals who've dedicated their lives to our planet. You'll find them at www.ford.com/heroes. Stop by. The world is waiting.

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EarthPulse

THE YEAR IN REVIEW

Is Your Finger on the Pulse?

Take this quiz to test your environmental awareness

From overfishing to green technology to endangered human cultures, EarthPulse examined major issues in 2001—issues underscored by the daily news. The debate over energy exploration focused on the Arctic National Wildlife Refuge and the Gulf of Mexico. California's power crisis eased, in part because consumers and businesses cut their energy use by as much as 12 percent.

The United Nations predicted that the world's population—which passed six billion in 1999—will likely exceed nine billion by 2050. Equally sobering was the climate change dilemma. A

panel warned that Earth's average temperature could rise 2.5 to 10 degrees F over the next century, 40 to 60 percent higher than earlier estimates.

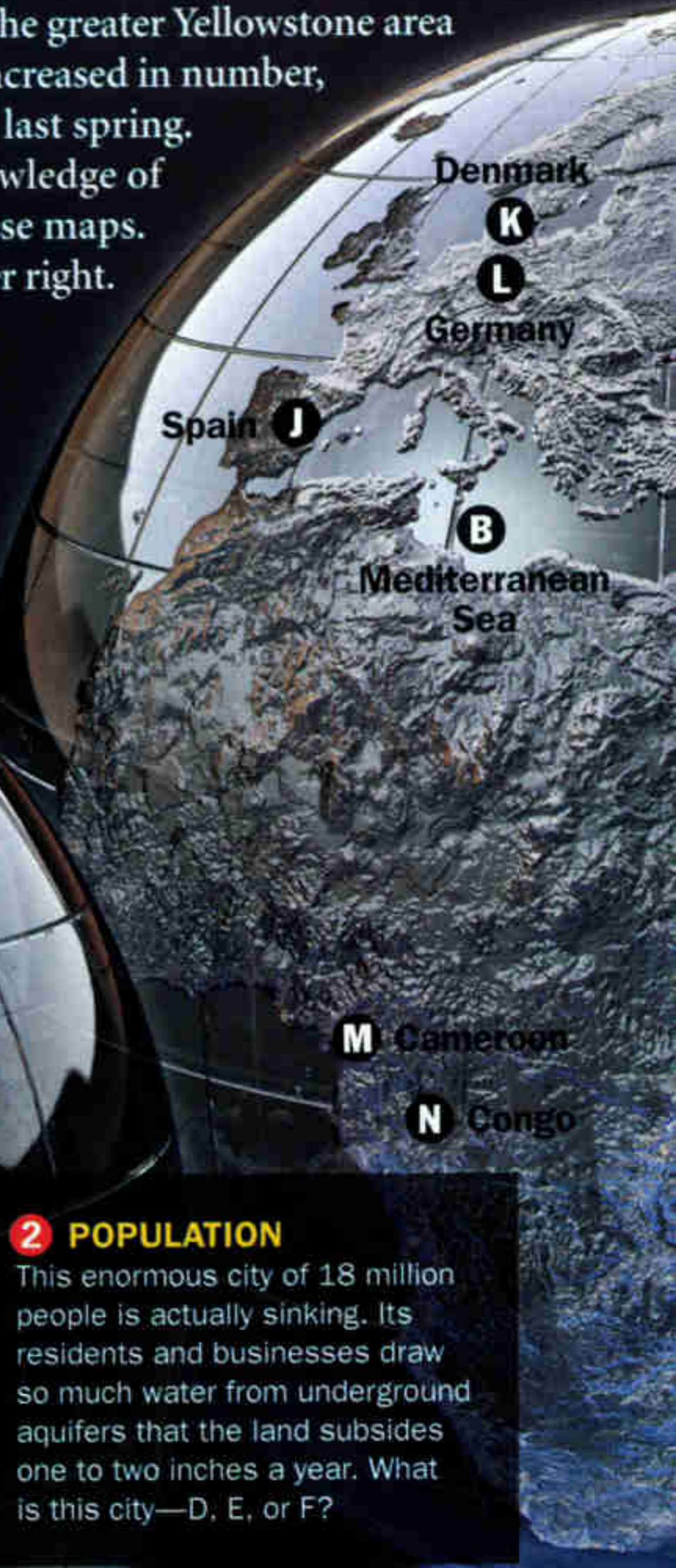
Efforts to aid wild species intensified. In China, a nationwide survey of pandas is under way, and 16 females were artificially inseminated at captive-breeding facilities. In the U.S., wolves reintroduced into the greater Yellowstone area during the 1990s increased in number, with 75 pups born last spring.

Check your knowledge of other issues on these maps. Answers are at lower right.



1 SAVING SEA TURTLES

Last summer nine countries signed an agreement to protect endangered loggerhead, leatherback, flatback, olive ridley, hawksbill, and green sea turtles. The agreement applies to the whole of this body of water. Which is it: A, B, or C?



D Tokyo

G China

P Nepal

Indian Ocean

A



2 POPULATION

This enormous city of 18 million people is actually sinking. Its residents and businesses draw so much water from underground aquifers that the land subsides one to two inches a year. What is this city—D, E, or F?



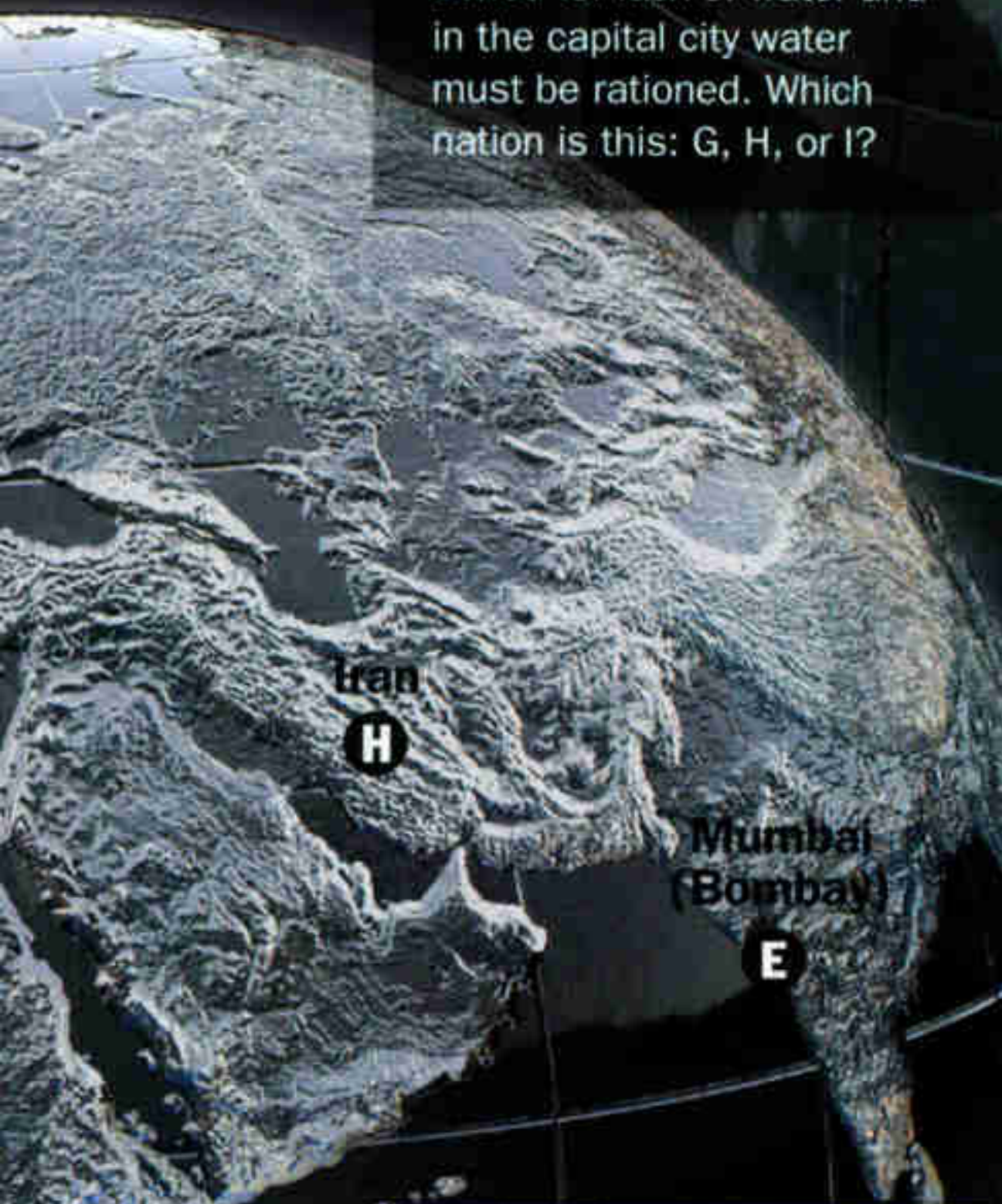
3 WATER CRISIS

Prolonged drought continues to plague millions of people throughout the world. In one country many villages have been abandoned for lack of water and in the capital city water must be rationed. Which nation is this: G, H, or I?



5 WILD SANCTUARY

The home of forest elephants, red colobus monkeys, gorillas, and chimpanzees that have never seen people was saved from the chain saw this year when a European timber company agreed to give up its right to log the parcel. Plans call for the land to become part of a national park. Where can it be found—M, N, or O?



4 HARNESSING WIND

At a European conference last July, wind turbine builders, scientists, and politicians discussed methods of increasing wind energy's role, already significant in some countries. Which European nation produces the highest percentage of its energy (15 percent) from wind: J, K, or L?



6 SHRINKING GLACIERS

A river swollen with glacial melt illustrates one effect of Earth's changing climate. Which country has seen its glaciers reduced in size by nearly a quarter over the past 30 years because of warming temperatures: P, Q, or R?

ANSWERS

- (1) A Indian Ocean
- (2) F Mexico City
- (3) H Iran
- (4) K Denmark
- (5) N Congo
- (6) Q Peru

ART BY ZOE ZEFF; PHOTOGRAPHS BY (1) BILL CURTSINGER, (2) STEPHANIE MAZE, (3) THOMAS J. ABERCROMBIE, (4) PAUL CHESLEY, (5) MICHAEL NICHOLS, NGS, (6) RAYMOND GEHMAN

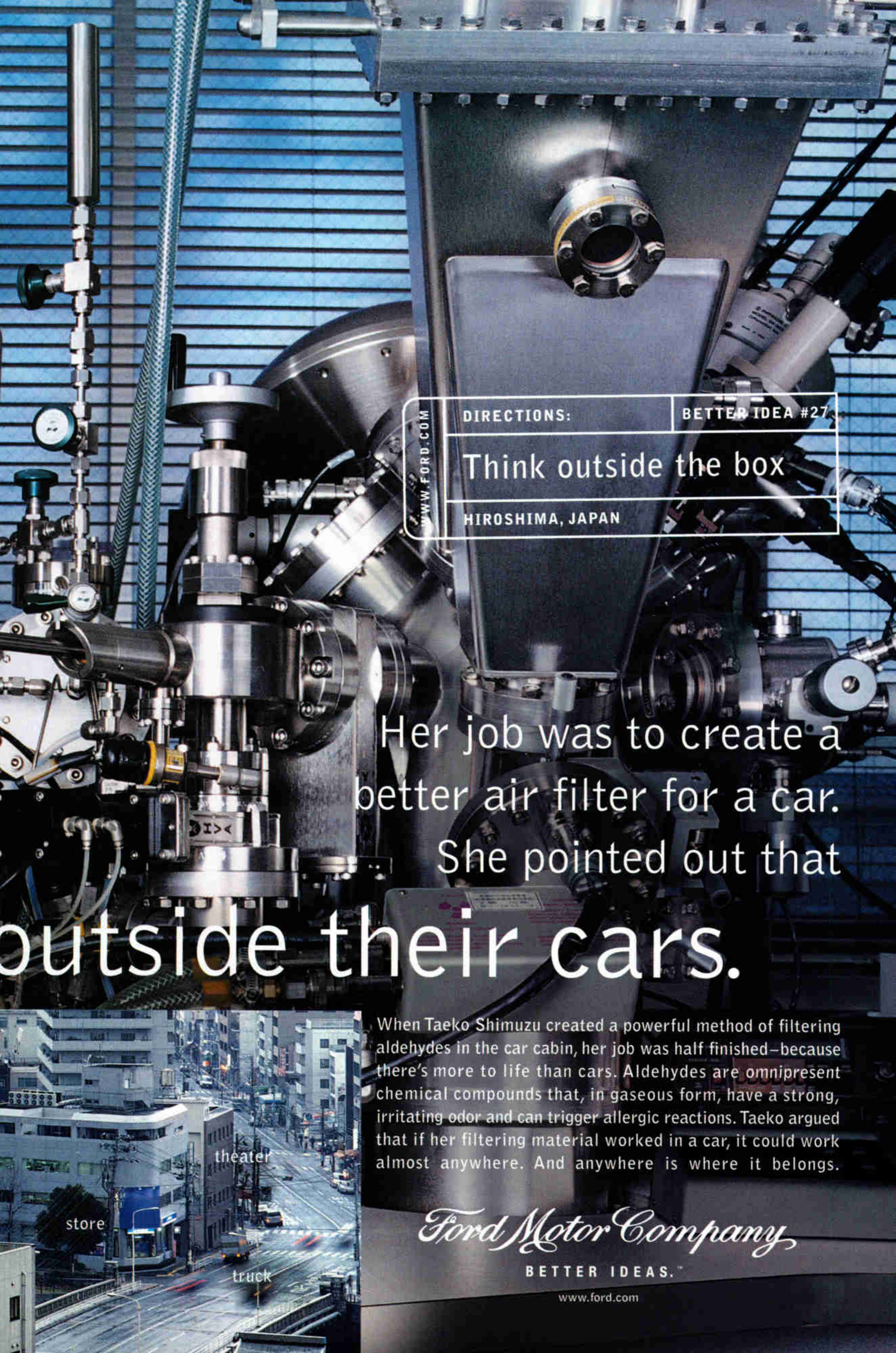
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Think outside the box

HIROSHIMA, JAPAN

Her job was to create a better air filter for a car. She pointed out that

outside their cars.



theater

store

truck

When Taeko Shimuzu created a powerful method of filtering aldehydes in the car cabin, her job was half finished—because there's more to life than cars. Aldehydes are omnipresent chemical compounds that, in gaseous form, have a strong, irritating odor and can trigger allergic reactions. Taeko argued that if her filtering material worked in a car, it could work almost anywhere. And anywhere is where it belongs.

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CULTURE

Sailing Away on Imagination

Around the world, children make their own fun

Toys are children's most precious possessions—especially when they have few possessions to begin with. So John Schultz, president of the Christian Children's Fund (CCF), was deeply moved when five-year-old Thomas Akimat Ekiru of Lake Turkana, Kenya (far right), insisted on giving him the toy sailboat he'd made from a broken sandal and a scrap of a plastic bag (right). Schultz realized that a collection of child-made toys could make the lives of youth in developing countries more understandable

to others. He asked CCF workers all over the world to send examples of such playthings to CCF headquarters in Richmond, Virginia. The collection of more than 300 toys tells a story of ingenuity with available materials. (Some of the creations are on exhibit through February 2002 at National Geographic's Explorers Hall in Washington, D.C.)

And Thomas? His spontaneous act of generosity came full circle. Schultz later returned to Kenya with a 21-foot motor-powered fiberglass fishing boat as a gift to the boy's village.

FRANCIE SCHULTZ (FAR RIGHT, TOP); O. LOUIS MAZZATENTA



WHEELED COCONUT-SHELL BOAT MADE BY ABDUL ROSIT, 11, OF INDONESIA



PULL TOY MADE OF PLASTIC OIL BOTTLE BY TONNY SEKIBENGO, 7, OF UGANDA



OIL TANKER MADE OF PESTICIDE CANS BY FALL AMATH YAYA, 14, OF SENEGAL



WOOD-AND-BAMBOO GYMNAST MADE BY PRABAKTI WIYOSO, 11, OF INDONESIA



SOCCER BALL MADE OF TWINE AND PLASTIC BAGS BY DAVID MBUGUA, 7, OF KENYA

AFRICA

CREATURES OF OUR UNIVERSE



SAILBOAT MADE OF RUBBER SANDAL AND PLASTIC BAG BY THOMAS AKIMAT EKIRU, 5, OF KENYA



PUSH TOY MADE OF SCRAP WIRE AND BOTTLE CAPS BY IAN KINUTHIA, 6, OF KENYA



SARDINE-CAN PULL TOY MADE BY KISLON EUSEBE, 9, OF DOMINICA



GUITAR MADE OF COOKING-OIL TIN BY OSCAR MIGUEL, 13, OF BRAZIL



DOLLS MADE BY EMILY WANJIKU, 6, OF KENYA; YAMILETH FABIOLA CASTAÑEDA, 4, OF GUATEMALA; AND CAROLYN WANJIRU, 6, OF KENYA



ROY TANAMI, URSUS

CONSERVATION

Pact Aids Spirit Bear

A ten-year battle among Canadian conservationists, timber companies, and Native Americans subsided last April with an agreement to ban, or in some places defer, logging on 3.5 million acres of what is known as the Great Bear Rain Forest on the coast of British Columbia. Included is more than 300,000 acres of habitat for a rare black bear subspecies called spirit, or Kermode, bears. About one out of ten is born white. There are about 400 white Kermodes, with roughly 80 on Princess Royal Island.

ASTRONOMY

In Search of Meteorites

Antarctic landscape is the best place to look

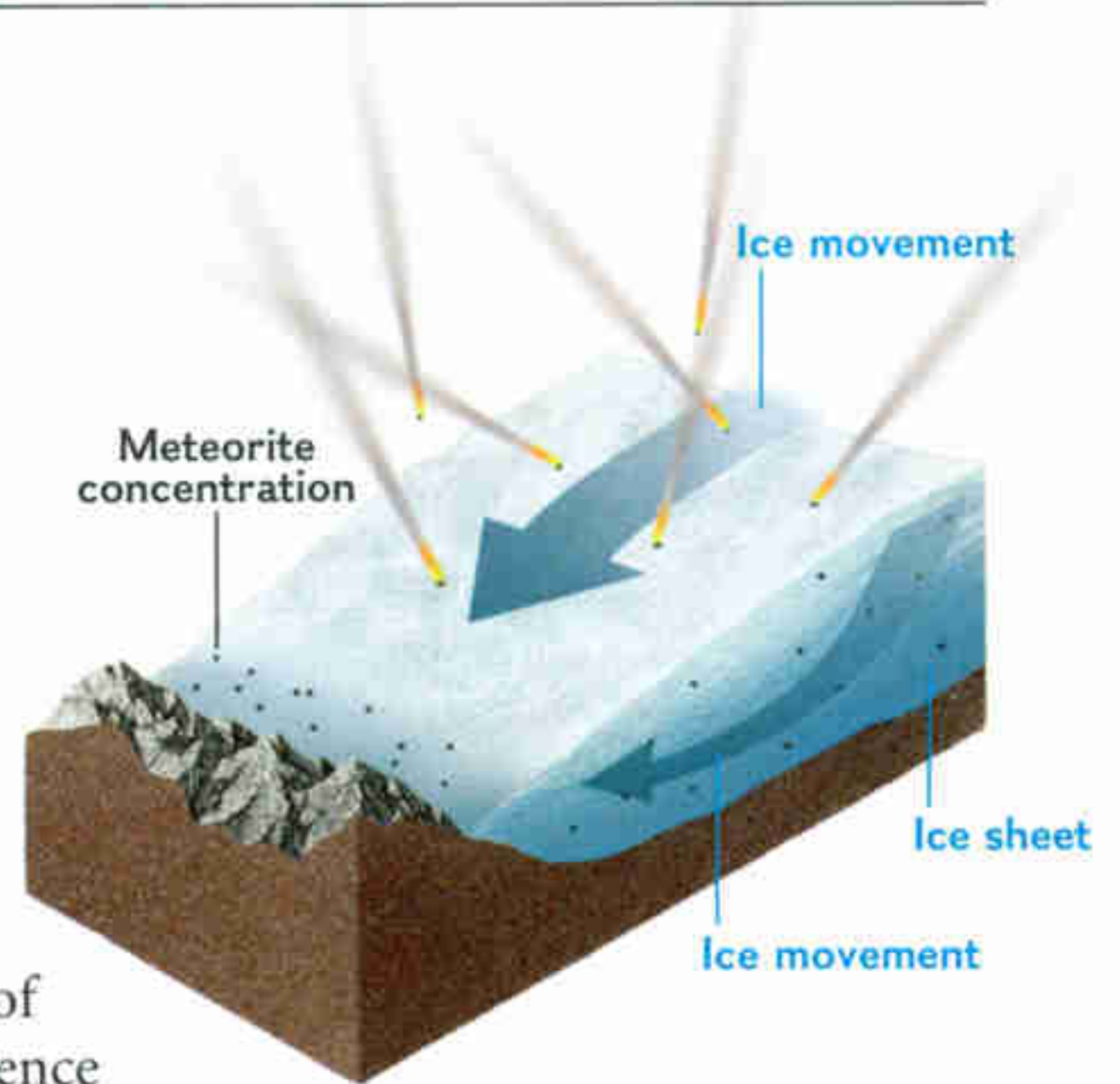
Scientists are gaining new information about the solar system by looking at rocks on the ground. Meteorites provide convenient space material for analysis. Meteorites land randomly all over the world, but the best place to spot them is Antarctica (map, below). The continent's ice sheet works like a conveyor belt, its slow flow (diagram, above right) bringing the dark space rocks to the surface, where they are easy to see on a field of ice.



O. LOUIS MAZZATENTA

been found in Antarctica since the first cluster was noticed by Japanese scientists in 1969. More than 11,000 of the specimens were recovered in a joint effort of the National Science Foundation, NASA, and the Smithsonian Institution. The rocks are distributed to scientists worldwide.

Most meteorites found in Antarctica are pieces of passing asteroids, though the collection also includes nuggets of Mars (above) and the moon.



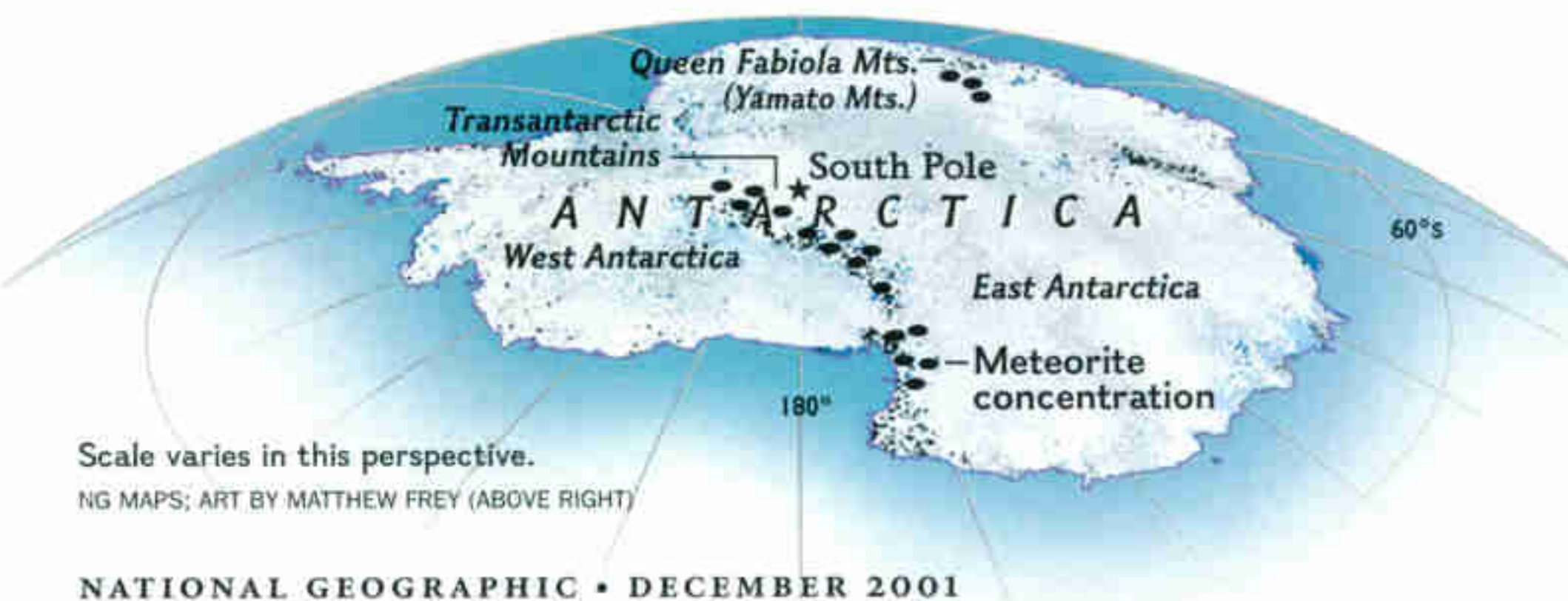
ALMANAC

December

A kiss under the mistletoe is but one of the holiday plant's boons. Druids and ancient Greeks valued its medicinal properties. Though mistletoe can be toxic, it and its extracts have been used to treat epilepsy, infertility, and arthritis—and its anticancer potential is being investigated.



ART BY SHAWN GOULD



Scale varies in this perspective. NG MAPS; ART BY MATTHEW FREY (ABOVE RIGHT)

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Behind the SCENES

AT THE NATIONAL GEOGRAPHIC SOCIETY

For 34 years Zahi Hawass has probed the past of his native Egypt, most recently as director of archaeology at the Giza Pyramids. Now Dr. Hawass (right, on a dig at the Bahariya Oasis) hopes to convey his adventures to the world as our newest explorer-in-residence. He has an ambitious schedule: to write books for children and articles for our magazines, to lecture in several U.S. cities, and, of course, to cooperate with the Society on archaeological projects. "I'm still director of the Pyramids," he points out. "I'm still working all the time in the field."

Bringing the Past Alive

Intrepid pyramid expert joins NGS in residence

KENNETH GARRETT

Sabbatical on an Icy Continent

NG researcher finds NSF work a bracing experience



MARIA STENZEL

When she was 14, Liz Connell saw a photograph of an iceberg in Antarctica and dreamed of going there. Last year the NATIONAL GEOGRAPHIC researcher (left) lived her dream, spending five months at McMurdo Station as a National Science Foundation administrative assistant. Liz found time to teach yoga, attend lectures, hike McMurdo on flag-marked routes, and even bowl. She also assisted photographer Maria Stenzel, on assignment for our story on Antarctica (page 2). Liz next plans a trip to Africa, the only continent she has yet to visit. "I grew up traveling in a Marine Corps family," she says. "I'm kind of addicted to it."



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VIAGRA[®]
(sildenafil citrate) tablets

This summary contains important information about VIAGRA[®]. It is not meant to take the place of your doctor's instructions. Read this information carefully before you start taking VIAGRA. Ask your doctor or pharmacist if you do not understand any of this information or if you want to know more about VIAGRA.

This medicine can help many men when it is used as prescribed by their doctors. However, VIAGRA is not for everyone. It is intended for use only by men who have a condition called erectile dysfunction. **VIAGRA must never be used by men who are taking medicines that contain nitrates of any kind, at any time. This includes nitroglycerin. If you take VIAGRA with any nitrate medicine your blood pressure could suddenly drop to an unsafe or life threatening level.**

What Is VIAGRA?

VIAGRA is a pill used to treat erectile dysfunction (impotence) in men. It can help many men who have erectile dysfunction get and keep an erection when they become sexually excited (stimulated).

You will not get an erection just by taking this medicine. VIAGRA helps a man with erectile dysfunction get an erection only when he is sexually excited.

How Sex Affects the Body

When a man is sexually excited, the penis rapidly fills with more blood than usual. The penis then expands and hardens. This is called an erection. After the man is done having sex, this extra blood flows out of the penis back into the body. The erection goes away. If an erection lasts for a long time (more than 6 hours), it can permanently damage your penis. You should call a doctor immediately if you ever have a prolonged erection that lasts more than 4 hours.

Some conditions and medicines interfere with this natural erection process. The penis cannot fill with enough blood. The man cannot have an erection. This is called erectile dysfunction if it becomes a frequent problem.

During sex, your heart works harder. Therefore sexual activity may not be advisable for people who have heart problems. Before you start any treatment for erectile dysfunction, ask your doctor if your heart is healthy enough to handle the extra strain of having sex. If you have chest pains, dizziness or nausea during sex, stop having sex and immediately tell your doctor you have had this problem.

How VIAGRA Works

VIAGRA enables many men with erectile dysfunction to respond to sexual stimulation. When a man is sexually excited, VIAGRA helps the penis fill with enough blood to cause an erection. After sex is over, the erection goes away.

VIAGRA Is Not for Everyone

As noted above (*How Sex Affects the Body*), ask your doctor if your heart is healthy enough for sexual activity.

If you take any medicines that contain nitrates—either regularly or as needed—you should never take VIAGRA. If you take VIAGRA with any nitrate medicine or recreational drug containing nitrates, your blood pressure could suddenly drop to an unsafe level. You could get dizzy, faint, or even have a heart attack or stroke. Nitrates are found in many prescription medicines that are used to treat angina (chest pain due to heart disease) such as:

- nitroglycerin (sprays, ointments, skin patches or pastes, and tablets that are swallowed or dissolved in the mouth)
- isosorbide mononitrate and isosorbide dinitrate (tablets that are swallowed, chewed, or dissolved in the mouth)

Nitrates are also found in recreational drugs such as amyl nitrate or nitrite ("poppers"). If you are not sure if any of your medicines contain nitrates, or if you do not understand what nitrates are, ask your doctor or pharmacist.

VIAGRA is only for patients with erectile dysfunction. VIAGRA is not for newborns, children, or women. Do not let anyone else take your VIAGRA. VIAGRA must be used only under a doctor's supervision.

What VIAGRA Does Not Do

- VIAGRA does not cure erectile dysfunction. It is a treatment for erectile dysfunction.
- VIAGRA does not protect you or your partner from getting sexually transmitted diseases, including HIV—the virus that causes AIDS.
- VIAGRA is not a hormone or an aphrodisiac.

What To Tell Your Doctor Before You Begin VIAGRA

Only your doctor can decide if VIAGRA is right for you. VIAGRA can cause mild, temporary lowering of your blood pressure. You will need to have a thorough medical exam to diagnose your erectile dysfunction and to find out if you can safely take VIAGRA alone or with your other medicines. Your doctor should determine if your heart is healthy enough to handle the extra strain of having sex.

Be sure to tell your doctor if you:

- have ever had any heart problems (e.g., angina, chest pain, heart failure, irregular heart beats, or heart attack)
- have ever had a stroke
- have low or high blood pressure

- have a rare inherited eye disease called retinitis pigmentosa
- have ever had any kidney problems
- have ever had any liver problems
- have ever had any blood problems, including sickle cell anemia or leukemia
- are allergic to sildenafil or any of the other ingredients of VIAGRA tablets
- have a deformed penis, Peyronie's disease, or ever had an erection that lasted more than 4 hours
- have stomach ulcers or any types of bleeding problems
- are taking any other medicines

VIAGRA and Other Medicines

Some medicines can change the way VIAGRA works. Tell your doctor about **any medicines** you are taking. Do not start or stop taking any medicines before checking with your doctor or pharmacist. This includes prescription and nonprescription medicines or remedies. Remember, VIAGRA should never be used with medicines that contain nitrates (see *VIAGRA Is Not for Everyone*). If you are taking a protease inhibitor, your dose may be adjusted (please see *Finding the Right Dose for You*.) VIAGRA should not be used with any other medical treatments that cause erections. These treatments include pills, medicines that are injected or inserted into the penis, implants or vacuum pumps.

Finding the Right Dose for You

VIAGRA comes in different doses (25 mg, 50 mg and 100 mg). If you do not get the results you expect, talk with your doctor. You and your doctor can determine the dose that works best for you.

- Do not take more VIAGRA than your doctor prescribes.
- If you think you need a larger dose of VIAGRA, check with your doctor.
- VIAGRA should not be taken more than once a day.

If you are older than age 65, or have serious liver or kidney problems, your doctor may start you at the lowest dose (25 mg) of VIAGRA. If you are taking protease inhibitors, such as for the treatment of HIV, your doctor may recommend a 25 mg dose and may limit you to a maximum single dose of 25 mg of VIAGRA in a 48 hour period.

How To Take VIAGRA

Take VIAGRA about one hour before you plan to have sex. Beginning in about 30 minutes and for up to 4 hours, VIAGRA can help you get an erection if you are sexually excited. If you take VIAGRA after a high-fat meal (such as a cheeseburger and french fries), the medicine may take a little longer to start working. VIAGRA can help you get an erection when you are sexually excited. You will not get an erection just by taking the pill.

Possible Side Effects

Like all medicines, VIAGRA can cause some side effects. These effects are usually mild to moderate and usually don't last longer than a few hours. Some of these side effects are more likely to occur with higher doses. The most common side effects of VIAGRA are headache, flushing of the face, and upset stomach. Less common side effects that may occur are temporary changes in color vision (such as trouble telling the difference between blue and green objects or having a blue color tinge to them), eyes being more sensitive to light, or blurred vision.

In rare instances, men have reported an erection that lasts many hours. You should call a doctor immediately if you ever have an erection that lasts more than 4 hours. If not treated right away, permanent damage to your penis could occur (see *How Sex Affects the Body*).

Heart attack, stroke, irregular heart beats, and death have been reported rarely in men taking VIAGRA. Most, but not all, of these men had heart problems before taking this medicine. It is not possible to determine whether these events were directly related to VIAGRA.

VIAGRA may cause other side effects besides those listed on this sheet. If you want more information or develop any side effects or symptoms you are concerned about, call your doctor.

Accidental Overdose

In case of accidental overdose, call your doctor right away.

Storing VIAGRA

Keep VIAGRA out of the reach of children. Keep VIAGRA in its original container. Store at room temperature, 59°–86°F (15°–30°C).

For More Information on VIAGRA

VIAGRA is a prescription medicine used to treat erectile dysfunction. Only your doctor can decide if it is right for you. This sheet is only a summary. If you have any questions or want more information about VIAGRA, talk with your doctor or pharmacist, visit www.viagra.com, or call 1-888-4VIAGRA.

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June 1999

VIAGRA[®]
(sildenafil citrate) tablets

From Clay to Crocodile

Sculptor strives to make a model with bite

For weeks Gary Staab's studio looked like a crocodile morgue. The Golden, Colorado, sculptor—fashioning life-size models of the colossal crocodylian that Explorer-in-Residence Paul Sereno found in Niger (page 84)—relied on the bones of modern crocs, as well as casts of the bones and skull sent him by Sereno, to aid his efforts. Guided by additional research, Gary built a basic armature, then loaded on 5,000 pounds of clay to come up with



LISSI STAAB

a nearly 40-foot-long reconstruction of the 110-million-year-old croc, one of the largest ever known. Fiberglass molds of the clay version were used to create two life-size models of *Sarcosuchus imperator* for traveling exhibits that will go to Australia, Asia, and South America. Staab also built a separate model of just the formidable head and neck.

"You get a mental image of what it's going to look like," says Gary, who worked for several natural history museums before becoming a freelancer. "But when you get to the reality of putting clay on the armature, it's always a surprise. You can't envision all the things that take shape as it evolves." His ultimate goal: "Trying to make the model of this animal believable."



BROOKS WALKER (ABOVE); U.S. AIR FORCE



Flying into History

Ten pilots took off in 1926 in five U.S. Army planes on a 22,000-mile flight along South America's coast. Two fliers were killed on the trip, which we covered in October 1927 in a 51-page article that included this route map. The map is now at the U.S. Air Force Museum near Dayton, Ohio, along with the trip's last surviving plane, the *San Francisco* (above).

Index 2001

Complete your NGS library with the 2001 annual index, a record of articles from *National Geographic*, *Adventure*, *Traveler*, and *World*. To order (\$6, plus shipping and handling) call 1-800-647-5463 or go to nationalgeographic.com. An 1888-1988 index of the *Geographic*, books, and TV Specials is \$29.95; a 1989-1998 *Geographic* update is \$15.95.

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My kid finishes his homework so fast,
I'm worried he'll start a band.

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AskUs

THE ANSWER PLACE

Our Research Correspondence staff responds to questions from curious readers.

Q How deep underground have humans traveled?

A Employees of the Savuka gold mine near Johannesburg, South Africa, venture down 2.3 miles to work the world's deepest mine. Although *savuka* means "rise up" in Zulu, the workday here begins with a 20-minute descent.

Q How can bee-eater birds swallow their prey without getting stung?

A Before swallowing a bee or wasp, a bee-eater bird (Meropidae) pounds or rubs the insect on a branch to remove the venom and stinger.

Q How long does it take for a drop of water to travel from the headwaters of the Colorado River to the Gulf of California?

A The journey, at best, takes four to six years, much of the time spent in Lakes Granby, Powell, and Mead. Many drops evaporate or are diverted for irrigation or municipal supplies. In some years no Colorado River water makes it to the Gulf of California.

MORE INFORMATION

Send questions to Ask Us, National Geographic Magazine, PO Box 96095, Washington, DC 20090-6095 or via the Internet to ngsaskus@nationalgeographic.com. Include name, address, and daytime phone number.



JOHN CANCALOSI

TELL US

Why does this English fallow buck have a grass headdress?

Think you know the answer? Go online to nationalgeographic.com/ngm/tellus/0112 and test yourself, or read it here in next month's issue.

November Answer Millions of flamingos nest along the shores of Lake Nakuru in west-central Kenya. When the birds spill onto its surface, their closely packed bodies seem to turn the lake's shallow waters pink.

Frozen



The mercies of moonlight, open water, and sunrise soon to come soften the Antarctic night in late summer. Known for harsh extremes—as the coldest, windiest, driest, darkest continent on Earth—Antarctica confers an otherworldly grace.



Under



Nearing the crater rim, Rick Aster paused for a warning: “Don’t try to run if it erupts. Just stand still, look up, and be ready to step aside if anything comes your way. This thing can throw lava bombs the size of a sofa.”

Aster, a geophysicist from the New Mexico Institute of Mining and Technology, issued this warning at the summit of Mount Erebus, a massive volcano thrusting nearly two and a half miles above the Ross Sea off the coast of East Antarctica.

Nausea Knob is the nickname volcanologists have given the top of this mountain at the bottom of the world, and it’s easy to smell why.

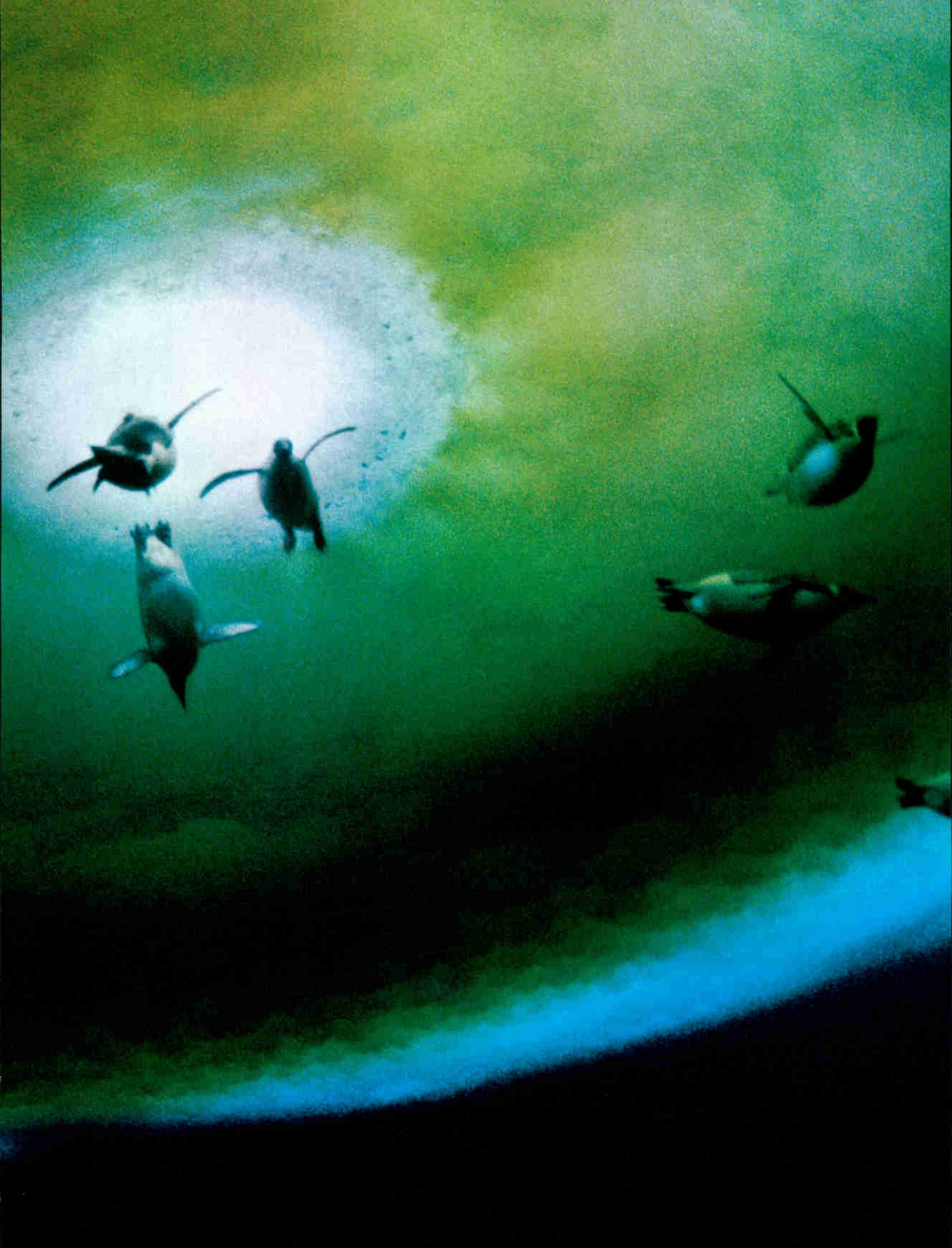
The sharp stink of hydrogen sulfide,

(Continued on page 12)



Though scientists worry about Antarctica’s warming climate, the change is not uniform. Near Cape Crozier the Ross Ice Shelf has grown several miles in the past two decades, creating a sheltered cove of sea ice for this emperor penguin colony. The colony has grown from 100 breeding pairs to 1,500.





The sea has no fences, but a single opening in the ice—the only breathing hole for miles around—restricts the swimming range of these emperors. A pen surrounds the hole topside, preventing escape and allowing scientists to study the birds' physiology and diving behavior.



Begging to be adopted, *an abandoned Weddell seal pup looks imploringly at photographer Maria Stenzel. “It was heartbreaking,” she says. “It kept crawling after us and crying.” The pup, presumably lost by its mother in a blizzard, eventually died.*





hydrochloric acid, and sulfur dioxide, along with high altitude, makes climbing here queasy work. But when I peered over the rim of the crater into a smoky chasm 2,000 feet across and more than 700 feet deep, queasiness gave way to awe. Jets of steam and acrid vapor hissed from vents in the rock far below, staining the cliffs a greenish yellow. At the bottom of the pit, partly obscured by swirling smoke, lay a pool of lava. A thin, peppery crust covered most of its surface, concealing the glowing coals underneath. Without warning it bubbled into a lurid orange bloom. The mountain rumbled like the deepest bass on a giant pipe organ.

“That lava has been bubbling for decades, perhaps centuries,” Aster explained. “You are looking at one of the few permanent lava lakes in the world—a living window into what goes on miles below the Earth’s surface.”

Panting in the thin air, I turned from the seething crater to gaze at the immense world

of ice and snow around me. It was late in the evening and clear enough to see the frozen peak of Mount Melbourne, 200 miles away. Pale gold sunlight shimmered on a glacier. The stillness was profound.

To polar explorer Ernest Shackleton, Antarctica was not merely the world’s highest, driest, and coldest continent but also a place that draws out the best in the human spirit. “In spite of this dusty workaday life I have ideals, and far away in my own White South I open my arms to the romance of it all and it abides with me now,” he wrote to a friend in England in 1917. Antarctica remains such a place, capable of reaching out and touching the imagination. In a world rapidly growing small and homogeneous, discoveries here are still made on a grand scale. As recently as 1996 satellite data revealed a huge lake—the existence of which was suspected since the mid-1970s—buried beneath two miles of ice near Vostok, an



Sharing its name with the gateway to hell in classical myth, Mount Erebus towers 2.5 miles over the Ross Sea. The volcano's crater harbors a perpetual lake of lava—one of only three on Earth.

old Russian outpost high on the polar plateau. Not since 1858, when Africa explorer John Speke stood on the banks of Lake Victoria, the main headwaters of the Nile, has such a vast “new” body of water been put on the map. And a stony meteorite found in the Transantarctic Mountains may hold evidence of life on Mars.

There are no places left like Antarctica: a wilderness continent that offers scientists unique views of the workings of the Earth—of active volcanoes, of fast-flowing glaciers, of unstable ice sheets that slide inexorably to the coast. Katabatic winds roll down the polar plateau at speeds up to 180 miles an hour. Some of the world's most violent squalls and mountainous seas batter the lonely archipelagoes off the Antarctic Peninsula. The interior may be a sterile void, where temperatures plunge to minus

120°F, yet the frigid waters that surround the continent are among the world's richest and most biologically diverse. Antarctica influences weather patterns across the Southern Hemisphere, shapes ocean currents throughout the world, and acts as a sobering litmus for humanity's use and abuse of the planet.

For all its remoteness and alien majesty, Antarctica is accessible now as never before. More than 250 flights land at the South Pole each summer, bringing construction crews and hundreds of tons of building material for the high-tech, 153-million-dollar base the United States Antarctic Program is building there. France and Italy are spending 25 million dollars to set up Concordia, an international research facility at a place called

Antarctica's Life

Adapting to Change

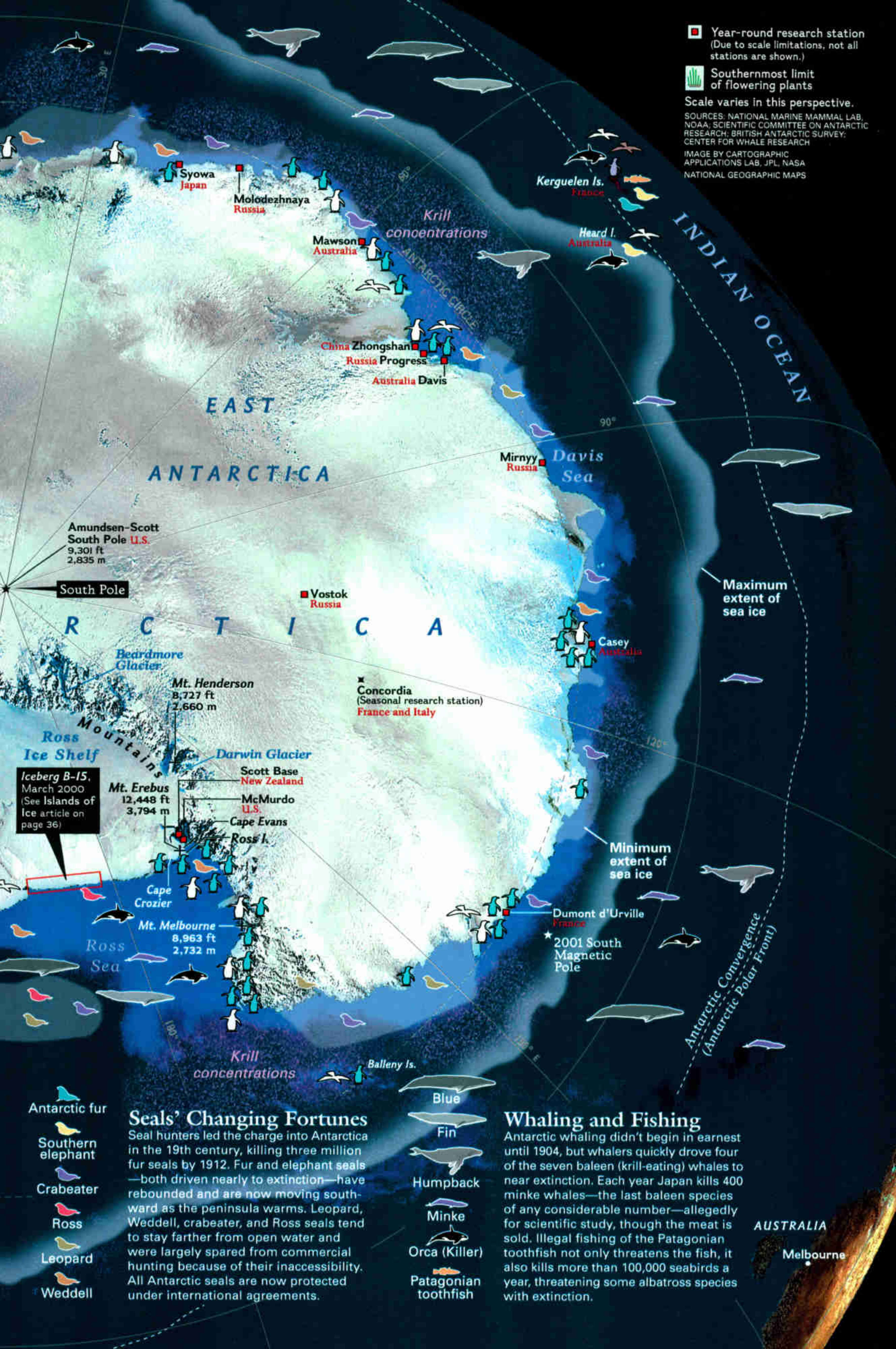


People who live there for any length of time call Antarctica “the Ice,” appropriate for a continent with a two-mile-thick cap of it. Though the ice is a long way from thawing, Antarctica’s climate is changing in alarming ways. The Antarctic Peninsula, 800 miles long and teeming with wildlife, has warmed about four degrees in the past 50 years and in winter is a staggering ten degrees warmer. Winter sea ice at its northern reaches has been so reduced in recent years that krill populations—which feed on algae that initially grow in the ice—are in danger of crashing. As krill are the basis of almost the entire Antarctic food web, seal, whale, and penguin populations could follow.

-  Emperor
-  Adélie
-  Chinstrap
-  Gentoo
-  Petrel
-  Albatross

Penguin Problems

The decline in krill along the Antarctic Peninsula has affected both Adélie and chinstraps, which during their breeding seasons rely on krill for almost all their diet. But the effects of warming vary by region. Near Palmer Station, more flexible chinstraps have moved into breeding grounds once dominated by Adélie, while farther south Adélie are thriving as warmer temperatures create more openings in the sea ice, providing greater access to food.



Year-round research station (Due to scale limitations, not all stations are shown.)

Southernmost limit of flowering plants

Scale varies in this perspective.

SOURCES: NATIONAL MARINE MAMMAL LAB, NOAA; SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH; BRITISH ANTARCTIC SURVEY; CENTER FOR WHALE RESEARCH

IMAGE BY CARTOGRAPHIC APPLICATIONS LAB, JPL, NASA NATIONAL GEOGRAPHIC MAPS

Amundsen-Scott South Pole U.S.
9,301 ft
2,835 m

South Pole

R O S S I A

Beardmore Glacier

Mt. Henderson
8,727 ft
2,660 m

Ross Mountains

Iceberg B-15, March 2000 (See Islands of Ice article on page 36)

Scott Base New Zealand

Mt. Erebus
12,448 ft
3,794 m

McMurdo U.S.

Cape Evans

Ross I.

Cape Crozier

Mt. Melbourne
8,963 ft
2,732 m

Ross Sea

Krill concentrations

- Antarctic fur
- Southern elephant
- Crabeater
- Ross
- Leopard
- Weddell

Seals' Changing Fortunes
Seal hunters led the charge into Antarctica in the 19th century, killing three million fur seals by 1912. Fur and elephant seals—both driven nearly to extinction—have rebounded and are now moving southward as the peninsula warms. Leopard, Weddell, crabeater, and Ross seals tend to stay farther from open water and were largely spared from commercial hunting because of their inaccessibility. All Antarctic seals are now protected under international agreements.

- Blue
- Fin
- Humpback
- Minke
- Orca (Killer)
- Patagonian toothfish

Whaling and Fishing
Antarctic whaling didn't begin in earnest until 1904, but whalers quickly drove four of the seven baleen (krill-eating) whales to near extinction. Each year Japan kills 400 minke whales—the last baleen species of any considerable number—allegedly for scientific study, though the meat is sold. Illegal fishing of the Patagonian toothfish not only threatens the fish, it also kills more than 100,000 seabirds a year, threatening some albatross species with extinction.

AUSTRALIA
Melbourne

INDIAN OCEAN

Maximum extent of sea ice

Minimum extent of sea ice

Antarctic Convergence (Antarctic Polar Front)

Mirnyy Russia
Davis Sea

Kerguelen Is. France

Heard I. Australia

Mawson Australia

China Zhongshan
Russia Progress

Australia Davis

Vostok Russia

Concordia (Seasonal research station) France and Italy

Casey Australia

Dumont d'Urville France

2001 South Magnetic Pole

Balleny Is.

Krill concentrations

ANTARCTIC GLACIER

EAST ANTARCTICA

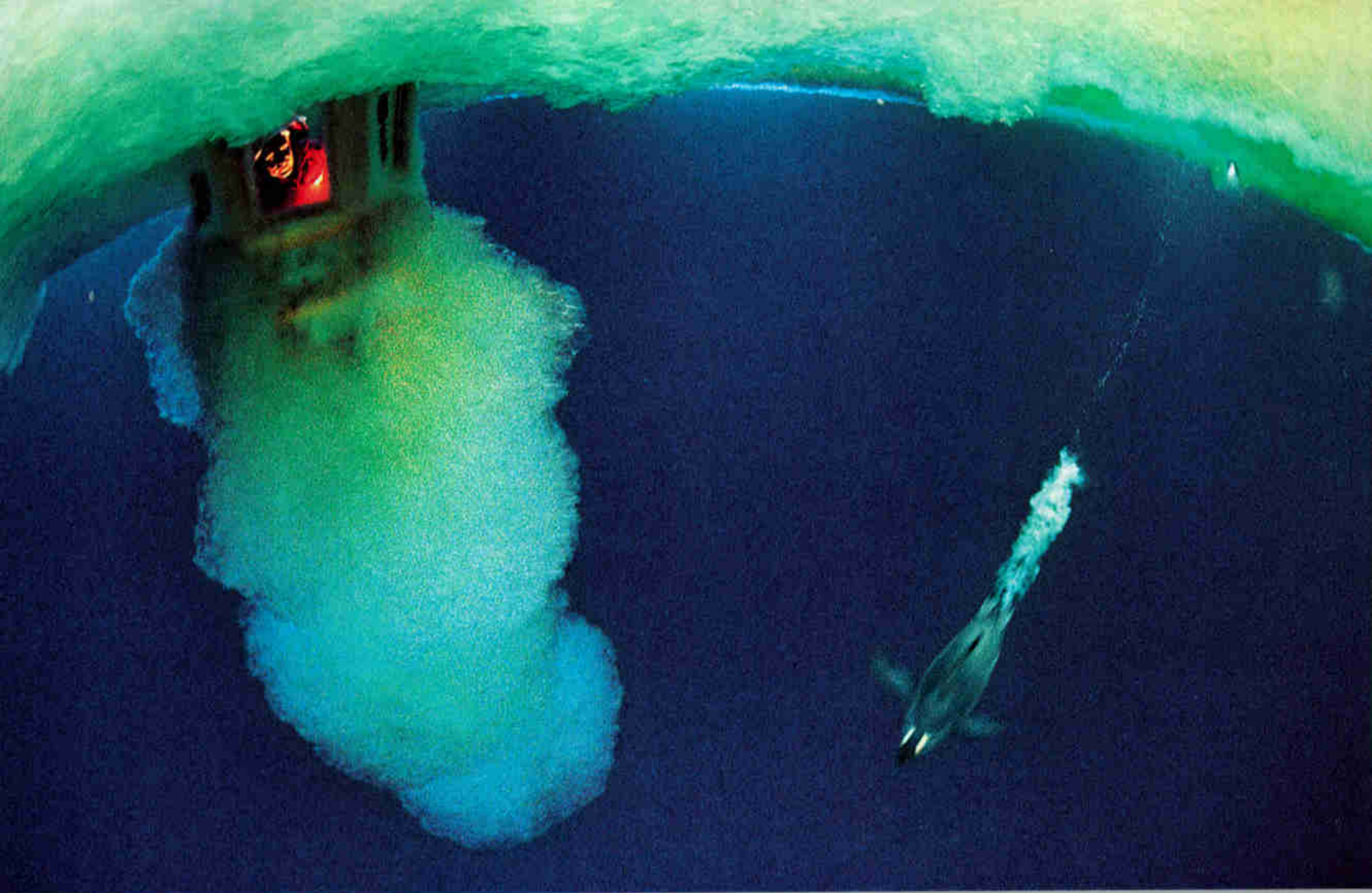
ANTARCTICA

90°

120°

180°

150° E



In McMurdo Sound an ice-sheathed observation tube under sea ice gives researchers an eye into the diving behavior of emperor penguins (above). Yet scientists here aren't learning only about things Antarctic. The thin, dry atmosphere makes the South Pole Earth's clearest window into space, and astronomers have erected several telescopes (right), including an infrared instrument that measures background radiation from the big bang. In West Antarctica a demonstration pit (below) shows how snow layers can be studied. A two-mile-deep ice core in East Antarctica has revealed that there are now more greenhouse gases in Earth's atmosphere than at any time in the past 420,000 years.



In a world rapidly growing
small and homogeneous, discoveries here are
still made on a grand scale.



Dome C—an even higher, colder, and more remote part of the polar plateau. Armadas of cruise ships bring more than 12,000 tourists every year, all in search of their own White South, and the numbers keep growing. Antarctica has even gone online. Want to know how cold it is at the South Pole? Its website (www.spole.gov) is only a mouse click away.

McMurdo Station, MacTown to its residents, is the local headquarters of the National Science Foundation, which operates the U.S. Antarctic Program at a cost of 200 million dollars a year. It is the largest settlement on the continent, with a summertime population of about 1,100, a busy airport, ATMs, speed-limit signs, and a shuttle bus that circulates commuters to New Zealand's Scott Base, two miles away.

MacTown sprawls over a rocky promontory on Ross Island, the classic gateway for expeditions to the interior since Robert Scott's first attempt on the South Pole in 1902. As I walked

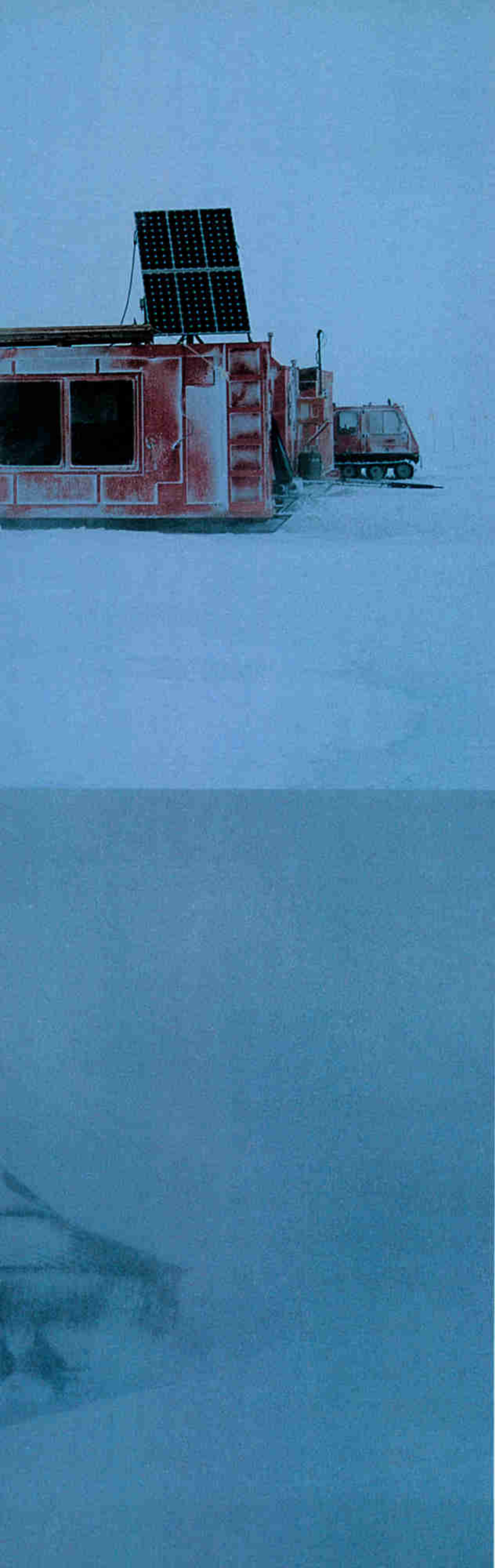
its muddy streets (the ice melts for a few weeks during high summer) I felt in turn as though I were at an Alaska mining camp, a technical college campus, and a base for the 109th Airlift Wing of the New York Air National Guard, whose pilots provide much of the transportation and logistical support on the continent.

But McMurdo's setting—the dazzling white panorama of the Royal Society Range that sweeps across the western sky—is pure Antarctica. The dazzle may not be the main draw for scientists, but it has a lot to do with bringing the summer support personnel, who outnumber scientists by about three to one.

"I would have taken any job," says Kristan Sabbatini, who left her home in Juneau, Alaska, for a summer job as a janitor at McMurdo. "When I saw the job ad on the Internet, I knew I had to go for it. It may only be cleaning toilets—but those toilets are in Antarctica."

For Kristan and her co-workers, Antarctica





Affectionately called a fish hut, a portable field station (left) shelters scientists camping on summer sea ice to study Weddell seals near McMurdo. With its solar panels, computer, and telephone, the station is posh compared with the hut built by Capt. Robert Scott's expedition at Cape Evans (preserved as a museum, bottom). Setting out from here in 1911, three of Scott's men hiked 130 miles in the dead of winter to collect a few penguin eggs—and almost died.

is a quirky existence of dormitory rooms, dining halls, bars, and insider jokes. “The first time you come down it’s for the adventure,” says Mark Melcon, a carpenter better known as “Commander,” who has spent 21 of the past 24 summers working in Antarctica. “The second time it’s for the money, and if you come after that, it’s because the people here have become your family.” Many full-timers joke that they are “bipolar,” since they often spend the other half of the year working in Greenland or elsewhere in the Arctic.

“This is a strange, almost classless, society,” observed Josh Landis, a journalist who gave up a rent-controlled apartment in trendy West Greenwich Village, New York, for a summer position as editor of the *Antarctic Sun* (circulation 700), the weekly newspaper for McMurdo Station and the South Pole. “Everybody dresses in the same red government-issue parkas. It is impossible to tell who is rich and who is poor, who is a world-famous scientist and who is the janitor. Down here it doesn’t matter.

“The only social distinction,” Landis said, “is mobility—who can get off the base and who has to stay. Mobility gives you status. A general assistant is one of the lowest paid jobs here—about \$350 a week—but since assistants often get out in the field to give scientists a hand, they are seriously envied.”

Nobody owns Antarctica. Earth’s fifth largest continent has been set aside as a natural reserve devoted to peace and science since the signing of the 1959 Antarctic Treaty. (Protection was extended to the surrounding oceans in 1982.) The treaty’s 45 signatories represent about 65 percent of humanity.

“This is the Switzerland of science,” says Chris Martin of the Harvard-Smithsonian Center for Astrophysics. “Scientists and universities that would be competitors in the real world are collaborators and colleagues here.”

The collaboration not only promotes science but also preserves Antarctica's considerable resources. Geologists already know there are coal seams in the Transantarctic Mountains. They suspect oil may lie in the offshore basins of the Antarctic Peninsula. Traces of gold, platinum, and copper have been found scattered around the continent. But at an international conference in 1991, treaty nations agreed to ban attempts at mineral extraction until at least 2048. For now science will be Antarctica's major industry.

Violent storms on the surface of the sun were playing havoc with communications across Antarctica the morning Jack Hawkins flew me by helicopter to Darwin Glacier. Hawkins was forced to relay his messages to McMurdo via a cargo plane flying above us en route to the South Pole. The casual grumbling of the flight crews, buglike in their visored helmets, coupled with the frozen wastes spreading out in every direction made me feel as though I had slipped into the pages of a post-apocalyptic novel.

Antarctica may be drier than the Sahara and as cold as Mars—and nearly as lifeless—but it wasn't always like this. We were on our way to a field camp in the Transantarctic Mountains, about 180 miles south of McMurdo, where geologists were looking back 270 million years to a time when Antarctica was a wilderness of forests, tundra, and marsh—and part of a giant continent called Gondwana.

"The scenery would have resembled parts of Alaska perhaps, with a few large glaciers around," said Rosemary Askin, a paleontologist with Ohio State University's Byrd Polar Research Center. Askin has been studying pollen in the fossil record to get an idea of Gondwana's climate and the age of Antarctica's rocks.

The next morning found us on an outcrop of Permian sandstone, about 8,500 feet up a splintery tower of rock and ice called Mount Henderson. It was a beautiful summer day—a balmy 38°F without a breath of wind—so that even though we were at 80° south latitude we worked in shirtsleeves. Chips of petrified wood as crisp as freshly hewn timber lay scattered under our boots, despite our being at least 2,000 miles from the nearest living tree. "This is probably *Glossopteris* wood," Askin explained, handing me the stump of an ancient

sapling. "It was a deciduous tree that also lived in South America, Africa, India, and Australia. Finding it in Antarctica was one of the things that proved the continents must have been linked at one time."

I turned it over in my hand, intrigued by its growth rings, tangible markers of seasons a quarter of a billion years distant. "When this was growing, Antarctica was about as far south as it is today," Askin continued. "You can see from the rings that the tree stopped growing during the long months of winter darkness, then grew extremely fast when the sun reappeared in summer."

As we scrambled over the rock, she pieced together a sequence of ancient landscapes as neatly as though turning the pages of a book—a glacial moraine, a muddy lake, a swamp that became a bed of coal. An ancient streambed showed the way currents had flowed 270 million years ago. The ancestors of modern horse-tail bushes, which flourished on the banks of this prehistoric stream, left crisp imprints in the sandstone. "That is one of the joys of working here," Askin said. "The dry polar climate preserves everything perfectly."

Glaciologists find an equally well-preserved record in Antarctica. More than 99 percent of the continent is covered by ice in massive beds up to 15,600 feet thick—the result of a slow but steady accumulation of snowfall over eons. Gas bubbles sealed in the ice act as atmospheric time capsules. By drilling ice cores and analyzing the bubbles to compare them with samples of today's atmosphere, glaciologists can follow the course of Earth's climate through the past 420,000 years, through four separate ice ages, and spot the sharp rise in greenhouse gases that are associated with mankind's burning of fossil fuels.

Antarctica is also the nest where man-made pollutants called chlorofluorocarbons come to roost. Stratospheric winds carry these compounds, long used in aerosols and coolants, south, where they mix with high-altitude clouds in the cold and dark of Antarctica's winter. As the sun returns in spring, these frozen chemical clouds react with its rays, releasing chlorine molecules that temporarily dissolve the thin layer of ozone that protects earthbound life from harmful solar radiation. First noted in 1985 by three British scientists working at Halley and Faraday Research



Coal and petrified wood speak of the trees and plants that once flourished on the continent, where grass now barely grows on its northernmost reaches. Part of a supercontinent called Gondwana, Antarctica 270 million years ago supported forests and tundra adapted to the dark winters.

Stations, the ozone hole reappears each spring.

For those who gaze outward to the rest of the universe, the last place on Earth has become a stepladder to the stars. When I boarded *City of Albany*, a ski-equipped LC-130 Hercules cargo plane bound for the South Pole, all of my fellow passengers were astrophysicists.

A three-hour flight up the Beardmore Glacier, where Shackleton and Scott both struggled for weeks, brought us to the ice runway at Amundsen-Scott South Pole Station, where *City of Albany* skidded to a halt in a roar of reversed engines and blowing snow. We scrambled out of the hatch, blinking in the polar glare and taking in the heartbreaking desolation that stretched to every horizon. It was a perfect summer day. The temperature stood at minus 28°F, the windchill at minus 54°, and a double halo of ice crystals circled the sun.

“Welcome to the South Pole,” said station manager Katy Jensen. She led us into the cavernous dome that forms the heart of the base. We took seats in a lounge area, where she went through the rules and peculiarities of life at the Pole: the weekly limit of two two-minute showers, cautions about frostbite, the need to acclimatize slowly to the 9,301-foot elevation. Raucous jubilation from the next room drowned out her briefing.

“Sounds like some pretty serious drinking going on,” I remarked.

“Yes, I expect so,” she laughed. “The fresh

milk came in on your plane—we’ve all been looking forward to it.”

Americans have been living continuously at the Pole since 1956. Drifting snow long ago buried the original base. With this in mind, work has begun on a new base, due to open in 2006, which can be jacked up periodically to keep it above the encroaching drifts.

“This is the nearest thing on Earth to building a space station,” maintains construction boss Carlton Walker. “Each part of the station is designed so that it can fit inside the hold of a Hercules and then be assembled here in some of the most extreme conditions imaginable. We’ve had to work in windchills of minus 142°. NASA is interested in how we manage this since it has real applications for them.”

“It’s the next best thing to being there,” says Jeffery Peterson, an astrophysicist from Carnegie Mellon University, about Antarctica’s hostile, spacelike conditions. Peterson is chief scientist for the high-resolution Viper radio telescope. “Viewing conditions here are nearly as good as for the Hubble Space Telescope. We are almost 10,000 feet high and hundreds of miles from the ocean. There is virtually no water vapor in the air, the sky is transparent, and the atmosphere is extremely stable. This is a perfect window to the universe.”

The discovery in 1965 of cosmic background radiation, the remnants of the big bang, generated a burst of interest in polar

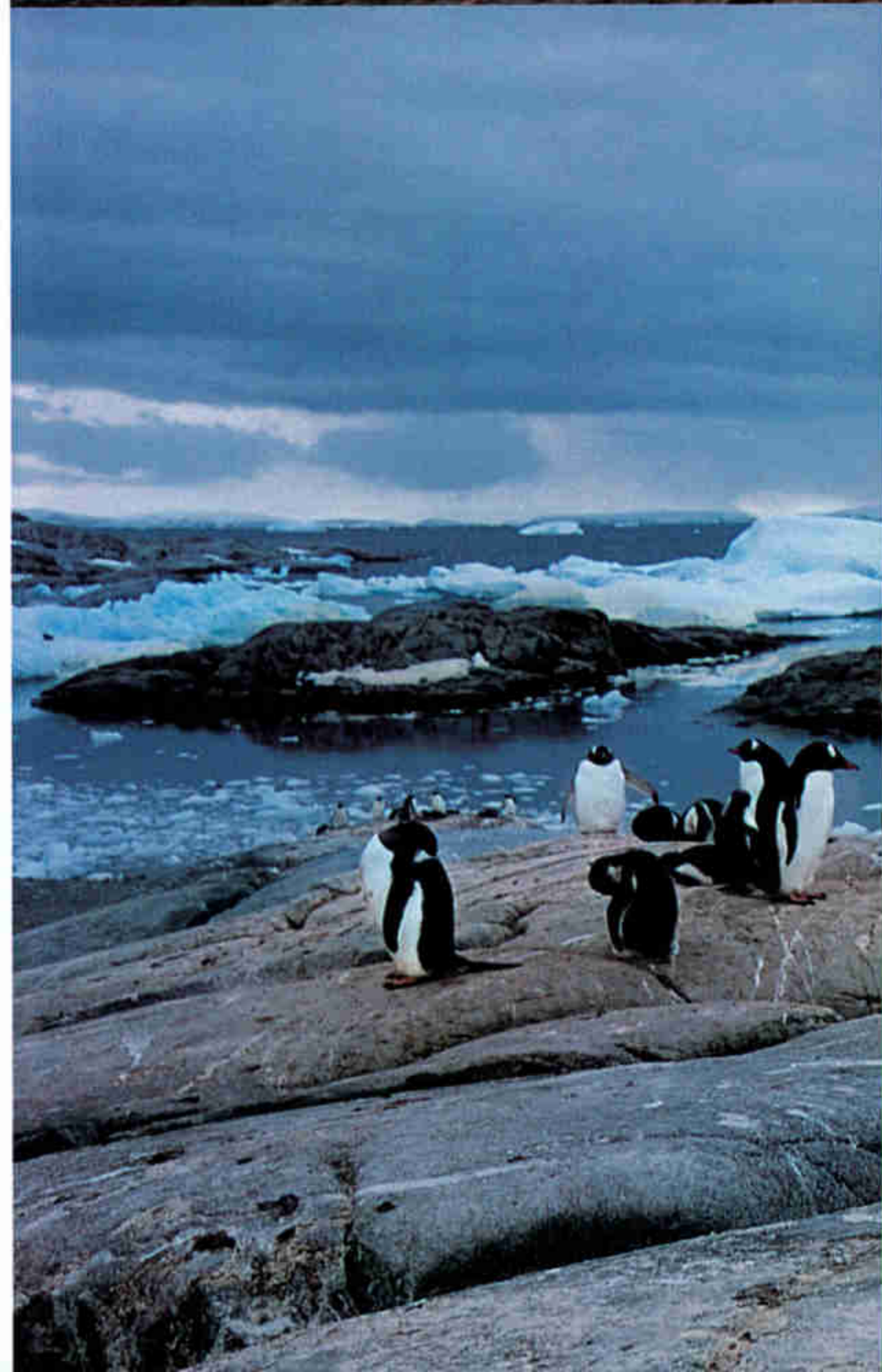
astronomy. “From here we can look back 13 billion years to a time when the universe existed simply as plasma—a vast cloud of incandescent gas,” says Peterson. Since 1991 the National Science Foundation’s Center for Astrophysical Research in Antarctica has built some of the world’s most sophisticated infrared, microwave, and radio telescopes at the South Pole. Peterson’s Viper radio telescope scans the cosmic background radiation looking for subtle temperature variations—as small as one one-hundred-thousandth of a degree—caused by the uneven distribution of matter in the first few seconds of the universe. These primeval seeds eventually curdled into vast structures such as stars, planets, galaxies, and clusters of galaxies. Another telescope, AST/RO, probes our own galaxy, looking at how stars form. Still another, DASI, deciphers clues to the size and shape of the universe, how it formed and how it might end.

The most bizarre is AMANDA—Antarctic Muon and Neutrino Detector Array—a gigantic telescope that isn’t pointed at the sky at all but is aimed instead into the ice in a search for elusive subatomic particles called neutrinos. These mysterious entities—no one is sure if they even have mass—slip through the universe like ghosts. Astronomers believe these emissaries from deep space can provide information about the birth of black holes, supernova explosions, and the power sources at the heart of galaxies.

But detecting a neutrino is difficult. “They leave no trace,” says Darryn Schneider, a physicist from the University of Wisconsin. “Occasionally, however, they interact with the polar ice after streaming through the Earth, and when this happens, a particle called a muon is created. Muons give off a blue glow, and this can be used to trace the path of the neutrino.”

Because muons are also created by cosmic rays in the upper atmosphere, the only way for

As if a long run through guano weren’t bad enough, Adélie chicks must pass muster with the parent they’re chasing (top) to be rewarded with a meal of vomit. When adults return from the sea with krill, they make their chicks chase them for as long as 30 minutes before regurgitating. This can help identify and reward the strongest offspring when food is scarce. With no sibling rivalry, a gentoo meal (right) is less frenzied.







Speckling the sea ice, *Adélie* penguins return to their chicks from the Ross Sea. As the warming climate makes northerly locales less hospitable, *Adélie* populations farther south boom; here at Cape Crozier there are now 170,000 breeding pairs.



scientists to be sure the muons they observe have actually been created by neutrinos is to point their telescope into the Earth, using the planet itself as a gigantic filter. AMANDA is a ring of 19 holes in the ice, all more than a mile deep, into which optical sensors arranged in long strings resembling Christmas tree lights have been lowered. "The ice is pure and transparent," says Schneider, "allowing us to see the muon's glow."

Christmas lights at home in Australia beckoned, and I left Antarctica for a few weeks, returning in January by way of the Drake Passage, the ferocious stretch of water south of Cape Horn. Force 10 gales are common. Seas can be huge. As the Chilean seaport of Punta Arenas slipped astern, I noticed the scientists around me were walking pharmacopoeias of scopolamine patches and Marezine, joking about the Drake tax—the toll in seasickness and discomfort that goes hand in hand with travel in these petulant waters.

I was aboard the *Yuzhmorgeologiya*, a Russian-flagged research vessel on charter to the U.S. Antarctic Marine Living Resources (USAMLR) program. The crew was heading south for a three-month survey of the Scotia Sea and the coastal waters off the South Shetland Islands as part of an ongoing study of Antarctica's marine ecosystem.

"That ultimately means krill," said Roger Hewitt, the expedition leader, referring to the tiny shrimplike creatures, *Euphausia superba*, that swarm in Antarctica's seas. "They are the common currency here. Everything eats them, from hundred-ton blue whales to seals and penguins, birds and fish, right on down to the tiny zooplankton that feed on krill larvae."

Humans too. Factory ships take about 100,000 tons of krill each year, together with thousands of tons of various species of fish such as Patagonian toothfish (also known as Chilean sea bass) and Antarctic cod. In an attempt to manage the rich fisheries in Antarctica's otherwise unsupervised waters, the Antarctic Treaty nations formed the Convention for the Conservation of Antarctic Marine Living Resources in 1982. This research voyage aboard the *Yuzhmorgeologiya* was part of the U.S. contribution to the convention's mission.

The Drake was kind. Two days of easy rollers brought us to the Antarctic Convergence,

where the cold, dense, nutrient-laden waters of Antarctica meet the warmer but less fertile currents from the north. On the gently heaving deck of the *Yuzhmorgeologiya* scientists from the U.S., Chile, Canada, Britain, and South Africa waited as the voyage's first sample net was slowly retrieved from a depth of 500 feet. Once on deck, eager hands opened the plastic canister at its tail. A thick pink sludge spilled out and was whisked into a laboratory set up in a shipping container on deck.

"We're looking at abundances as well as the variety of species in the samples," said Kit Clark, a marine biology student from the University of California. "With the krill we measure the length of their bodies, record their sex, and describe their reproductive state. This helps us estimate their age and understand their population demographics."

Over the next few weeks the *Yuzhmorgeologiya* would steam a sequence of 105-mile-long courses through some of Antarctica's best krill fishing grounds, netting samples every 15 miles and using state-of-the-art hydroacoustics to take sonar snapshots of sea life—everything from whales to krill larvae—down to depths of 1,600 feet. "We want to get the broadest possible picture of the zooplankton community down here," said Valerie Loeb, an oceanographer at California State University, "and then start looking at it in relation to long-term temperature data and climate change."

A survey by an international team of scientists in the summer of 2000 was spurred by concerns that krill stocks may have plummeted by 80 percent since the last major audit in 1981. "We suspect that warmer winters may be having an impact on krill's ability to breed successfully," Loeb said. "Krill feed on algae that grow on the bottom of winter sea ice, but cold winters with extensive sea ice are becoming less frequent. The last successful breeding year for krill was 1995."

I asked Hewitt whether commercial fishing could be causing problems. "We are not as concerned about the quantity of krill being harvested," he said, "as we are about where and when it is being caught."

Krill congregate along submerged shelves and off points of land—convenient pickings for land-based krill predators such as seals and penguins, which establish breeding colonies nearby. "These same easy pickings draw the



Patience pays off for biologist Donna Patterson, who after years of studying giant petrels on Humble Island is able to handle chicks without alarming the parents. Banded as a chick in 1979, this male is outfitted with a small satellite transmitter that allows Patterson to track his every move.

fishing fleets,” Hewitt explained. “Virtually all krill fishing is done within 50 miles of these colonies, so while 100,000 tons isn’t much in terms of overall krill biomass, it may represent a large portion of the wildlife’s food source.”

I arranged to join up with a team of researchers on Livingston Island, one of the larger members of the South Shetland archipelago, who study krill from a predator’s viewpoint. The *Yuzhmorgeologiya* anchored off the island on a drizzly morning. A heavy sea was rolling, driven by a 40-knot gale.

“This is as good as it gets,” Hewitt yelled above the wind as we began the transfer from ship to shore. I’d been clinging to a rope ladder hanging over the side of the ship, watching the Zodiac below dance on the waves. A sudden surge had boosted it to where Hewitt’s head was nearly level with my ankles. I let go of the ladder and sprang, tumbling into the dinghy just as it plunged away. Icy spray slapped my face as I clutched the gunwales. When I looked back, the 5,600-ton Russian trawler seemed to have disappeared in the swell. It reemerged, then sank from sight again as we plunged into another deep trough. Two miles ahead and partly obscured by mist lay Livingston Island’s Cape Shirreff. I felt like a smuggler.

Such landings are nothing new to Wayne Trivelpiece, the director of seabird research for the USAMLR program. “I’ve been coming down here every summer for the past 25 years,”

he said. He led me along the coast, which was covered with thousands of fur seals and dotted with the nests of 7,700 breeding pairs of chinstrap penguins. They looked surreal, like computer generated extras in a film. The air reeked of guano. Millions of pink splotches on the rocks bore testament to a steady diet of krill.

“By monitoring penguin and fur seal colonies, we can get a pretty accurate idea of how healthy krill stocks are,” Trivelpiece said. “During the past ten years we have seen a sharp decline in the survival rate of penguin chicks. Their parents are doing quite well and breeding successfully, but the naive chicks are just not surviving those first tenuous weeks of foraging on their own. With so few krill close by, they have to swim out farther and longer in search of food, making themselves easy snacks for leopard seals.”

Equally worrying is the lack of young krill showing up in the penguins’ diets, an indication that the krill themselves are not breeding successfully.

“Looking over meteorological records going back to 1903, we are seeing a gradual warming trend here since the 1940s,” Trivelpiece said. “NOAA satellite images also record a pronounced change in the cycle of winter sea ice since about 1970. Instead of consistently extensive winter pack we are now getting maybe two good years followed by up to five warm, ice-free winters. No ice means no food for the





Raking her teeth *across the bottom of the sea ice, a Weddell seal widens a breathing hole for her and her pup. With teeth uniquely angled for this task, Weddell seals are able to winter farther south than any other mammal on the planet. The downside: Tooth wear may cut their life span short.*



Air is free but not cheap to Weddell seals, which depend on breathing holes to survive far from open water. Two seals briefly skirmishing near an ice hole (above) provide a glimpse of the competition that occurs over access—especially among males, which monopolize mates by controlling one or more holes. For Weddells life happens underwater, and even seals atop the ice will spend hours peering through holes to watch the action (right). Able to stay underwater for more than an hour and dive as deep as 2,000 feet, they need time at the surface to recover (below). Safe from land predators and thus unafraid of humans, Weddells are the best studied of Antarctica's seals.



The interior may be a sterile void,
yet the frigid waters that surround the continent are among
the world's richest and most biologically diverse.



young krill. What we are seeing here is the first evidence of how a shift in climate may have a surprisingly quick and dramatic impact.”

I left Cape Shirreff aboard the *Golden Fleece*, a 65-foot yacht skippered by Jérôme Poncet, a Frenchman who has explored these waters for 30 years and co-authored several scientific papers on the peninsula's wildlife and grasses.

It was late in the evening two days later when we sailed into Maxwell Bay, a picture-postcard anchorage surrounded by glaciers and mountains on the southern tip of King George Island. The lights of scattered bases twinkling along the shore coupled with the blues CD throbbing softly in the wheelhouse gave the bay an appropriately cosmopolitan feel.

King George Island is Antarctica's Manhattan, a melting pot where Argentina, Brazil, Chile, China, Poland, Russia, South Korea, and Uruguay all maintain year-round bases. Other nations, including the U.S., Ecuador,

Peru, Germany, Netherlands, and the Czech Republic, operate summer camps here as well.

There is a reason this 500-square-mile island is the trendiest real estate in Antarctica, but it has less to do with science than with location. King George Island lies only 600 miles from South America and has a 4,400-foot airstrip to provide quick access. Under the terms of the Antarctic Treaty only nations conducting scientific research in Antarctica have a voice in shaping the continent's future. Setting up a base on King George Island is the simplest way to get that voice.

“We had little experience in Antarctica until we came here in 1988,” said Soon-Keun Chang, the commanding officer at South Korea's King Sejong Station. “We considered putting a station on the continent itself, but we realized that would have been much too difficult and expensive to start off with. This seemed like a good place to learn our way around.”

Chang spends his winters writing children's books about Antarctica's wildlife and its early explorers. "Antarctica is something new to us in Korea," he explained. "It is important for our children to learn what it means to the world."

It is this softer side of science that gives King George Island its human face. While environmentalists decry the superfluous bases crowded on the island—and it is true that many are here mainly to fly the flag—others see it as a unique international community.

"Here we have a beginning, a light," says Sergio Lizasoain, 69-year-old chief of operations for Chile's Antarctic program, who first came to Antarctica in 1957 during the International Geophysical Year (IGY). "Look around you. On this little island we have people from all over the world living in harmony with each other. There are no borders, no passports, no politics—this is what we had hoped would come about all those years ago during the IGY."

Chile's Presidente Eduardo Frei Base, at the head of Maxwell Bay, is the de facto capital of King George Island. Frei is a town of about 300, complete with minimarket, hospital, post office, chapel, bank, airport, school, and a suburb of ranch-style houses painted in pastel yellows, greens, pinks, and blues. "Antarctica is a great place to bring up kids," María Inés Komlos, the wife of the base commander, told me. "Everything is very family oriented here. It is safe, clean, there are no drugs, no bad influences—just the penguins," she laughed.

We were sitting in the elegantly furnished living room of her three-bedroom home, the Three Tenors singing softly on a stereo in the background. Outside, her two children—twelve-year-old Juan Pablo and ten-year-old Javiera—played on sleds and threw snowballs. "My friends in Santiago thought I might miss the shopping malls during the two years we'll be here," she continued, "but I haven't really missed anything. I still play tennis a couple of times a week in the gymnasium, and we have card nights with friends—things people in small towns do everywhere. We watch the same TV channels that we'd watch at home, and if there is something we can't buy at the supermarket, we can always order it on the Internet."

Chile is one of seven nations that formally claim territory in Antarctica. Although no territorial claims are recognized and all are officially held in abeyance under the terms of the

Antarctic Treaty, such homesteading keeps aspirations alive.

Argentina has a similar philosophy, settling families at Esperanza, its village-like base at Hope Bay, on the tip of the Antarctic Peninsula. "We've had eight babies born here," Juan Carlos Perez Arrieu, the base commander, told me when I stopped in to visit. He showed me the little schoolhouse, quiet now that the base's eight children were in Buenos Aires on summer holiday. "We have the same curriculum here as all the other schools in the state of Tierra del Fuego," he said. I smiled, my mind wandering back to Chile and the yellow pages I had seen in Punta Arenas, which had included numbers in Antarctica. School districts, phone books, and proprietary hospitality—no continent in history has been more urbanely staked out.

It's the Russians who've provided the nearest thing to an invading armada. The collapse of the Soviet Union forced cash-strapped Russian academies to lease their ice-strengthened research vessels to Western tour operators in exchange for hard currency. Antarctica's doors were suddenly thrown wide open. And now every evening around 7:30 the radio in the *Golden Fleece's* wheelhouse crackles to life as cruise directors on the tour ships working these waters call each other to coordinate their next day's movements. "Nobody wants to pay \$20,000 to come to Antarctica and then spend all their time seeing other tourists," explained Poncet, himself a member of the International Association of Antarctica Tour Operators.

It is getting harder and harder to avoid. Tourism in Antarctica is booming—growing by 500 percent in the past decade with little sign of slowing down. Last summer more than 12,000 visitors came to the Ice, mostly on cruise ships from South America. Another 3,000 or so took 14-hour scenic flights from Australia. And an increasing number of adventure travelers are booking guided expeditions—mountaineering, sea kayaking, even 65-day ski treks to the South Pole at the price of \$45,000 a head.

We caught up with one cruise ship, *Clipper Adventurer*, off Paulet Island—a tiny volcanic nub near the Weddell Sea, popular with tourists because of its enormous colony of 60,000



Taking a break from her 280-passenger cruise ship, a German tourist bathes in the geothermally heated waters of Deception Island. In 1967 Lars-Eric Lindblad built the first Antarctic cruise ship. “You can’t protect what you don’t know,” he said. Today 15,000 tourists a year visit the continent.

pairs of Adélie penguins. Many of the 113 passengers were ashore, bright in matching red parkas. Most were elderly Americans. Typical were Karen and Bill McClure, of Columbus, Mississippi, who took to cruising after retiring in 1997. “This is our seventh continent,” they told me. “We got the idea to come to Antarctica from someone we met on another cruise, and now we’re hooked. We simply had no idea how spectacular it is down here.”

Governments have traditionally been leery of tourists in Antarctica—mainly out of fear of the whopping rescue bills should something go wrong—but with tourism here to stay, some are getting into the act themselves. In 1996 the British Antarctic Survey, together with the U.K. Antarctic Heritage Trust, restored the derelict base at Port Lockroy and converted it to a stylish museum, complete with gift shop and post office. Almost overnight this 1940s relic became one of Antarctica’s most popular tourist attractions, drawing some 7,000 visitors each summer.

We sailed into the picturesque harbor on a sparkling January morning. The weather-beaten hut was nestled on a low, rocky point and might have been a New England lobster shack—except for the gentoo penguins waddling on the porch. Inside the shop I found Jim Fox, a former base commander at Britain’s Halley Research Station, sitting behind an old desk franking the mountain of postcards left

by tourists from a cruise ship that had visited the previous day. “I’m trying to catch up while it’s quiet,” he laughed. “Normally we can expect a ship in here every day.”

More than 40,000 pieces of tourist mail pass through Port Lockroy’s classic red English postbox each summer, while its shop does a brisk trade in T-shirts, postcards, posters, caps, pins, and patches. There are even ties and scarves woven by a firm in Scotland in an “authentic” Antarctic tartan. “We’ve already sold out of those,” Fox said. “They proved very popular with Americans.”

Aside from raising money for the museum and other preservation projects, Port Lockroy’s tourist appeal also serves a scientific function. By monitoring the health and breeding success of the area’s 900 pairs of gentoo penguins, scientists hope to gauge the impact tourism might have on wildlife. So far the news appears to be good. “There’s no difference between these penguins that see tourists all the time and those that see none at all,” says Fox. Similar studies have come to the same conclusion.

“The way things work now, tourism isn’t a problem,” Fox said cautiously. “Most come by ship and make a few brief landings. By and large the tour operators do a good job of regulating themselves. But sooner or later someone is going to try to build a hotel down here, and once that happens, answers are going to have to be found for some thorny legal and

political questions we've all been putting off."

At Britain's Rothera Research Station the talk is of UV radiation and rapidly warming temperatures rather than tourism. "The Antarctic Peninsula is the world's finest natural laboratory for studying the biological consequences of climate change," says senior scientist Pete Convey. "Nowhere else on Earth can you travel through such a wide gradient of latitudes—from 54° south down to 69° south, perhaps even farther—and directly observe how changes in temperature, ultraviolet radiation, and water affect the same basic community of species."

Convey is conducting a survey to map the outer limits of life on Earth. When we met, he had just returned from an expedition to sample lichens and soil microbes from Ellsworth Land, more than 500 miles farther south.

Jérôme Poncet, during our journey along the Antarctic Peninsula, planned to stop at another remote spot—a little-known archipelago named the Terra Firma Islands, lying at 68° 42' south. It was here, in 1984, that Poncet discovered the southernmost location of the world's southernmost flower, a cushion plant called *Colobanthus quitensis*, and its southernmost grass, *Deschampsia antarctica*. With typical Antarctic neighborliness he'd agreed to bring back some samples for Convey. We set off at dawn, navigating seldom visited waters with an Admiralty chart that warned of misplaced capes, uncharted reefs, and "numerous unidentified dangers thought likely to exist."

We arrived in the fragile brightness of a midnight sun. Skuas wheeled in front of thousand-foot cliffs. We went ashore and clambered up the steep rock. I had expected something wind whipped and barely clinging to life, but what I saw was delicate, soft, and lush.

"Beautiful, aren't they?" Poncet knelt beside the plants, studying the pale green buds with the tenderness of a gardener, cultivating his own White South. We gathered our samples. As we made our way down to the ship, Poncet motioned to the islands, sculpted icebergs, and mountains in the distance. "I claim these," he laughed. "I am a citizen of the world, and these belong to the world."

MORE ON OUR WEBSITE

Experience the sights and sounds of White South at nationalgeographic.com/ngm/0112. AOL Keyword: NatGeoMag



Whale bones seem to hold a penguin audience in thrall

There are no places left like Antarctica:
a wilderness continent that offers scientists unique
views of the workings of the Earth.



at Port Lockroy. The old whalers' anchorage is also a popular stopover for human tourists. □



Exploring Antarctica's

Descending in water as cold as water can get, Jill Heinerth leads a fellow diver into a broad crevasse within an iceberg, whose wall is dimpled like a golf ball. When currents turn against the divers a thousand feet in, the situation turns dangerous.

Islands of

Ice

Thunderous seas, banshee winds, and gnawing pack ice were just the entry fee for a team's scientific investigations of Antarctic icebergs—one of them a giant of giants.

BY GREGORY S. STONE

PHOTOGRAPHS BY WES SKILES





The Antarctic sun glowed red on the horizon at 1 a.m. A mile and a half from the deck of *Braveheart* an iceberg the size of six city blocks—the iceberg we'd been tethered to just hours before—heaved upward, one end pausing high in the air like the bow of a foundering ship. When it crashed back down, waves swept through the waters off Cape Hallett. As the boat rocked, the iceberg rose again, and the upper end of it seemed to explode. It was not long before ice shards covered two square miles like shattered crystal.

Such an event has rarely been recorded by humans, and it reinforced our sense of the tremendous power, complexity, and danger of the Antarctic icebergs we had come to study. One in particular was cruising the Ross Sea some 125 miles from where we were.

Its name was B-15B, a 1,900-square-mile chunk of the original B-15,



which, when it calved from the Ross Ice Shelf in March 2000, had an upper surface area of about 4,500 square miles and was estimated to contain enough fresh water to supply the United States for five years.

A berg with the dimensions of B-15 comes along once or maybe twice in a lifetime. The National Ice Center in Suitland, Maryland, which has been tracking Antarctic icebergs with satellite mapping techniques for 25 years, has never recorded a berg as big. For nine years satellite images recorded the cracks in the Ross Ice Shelf as they spread and set B-15 loose.

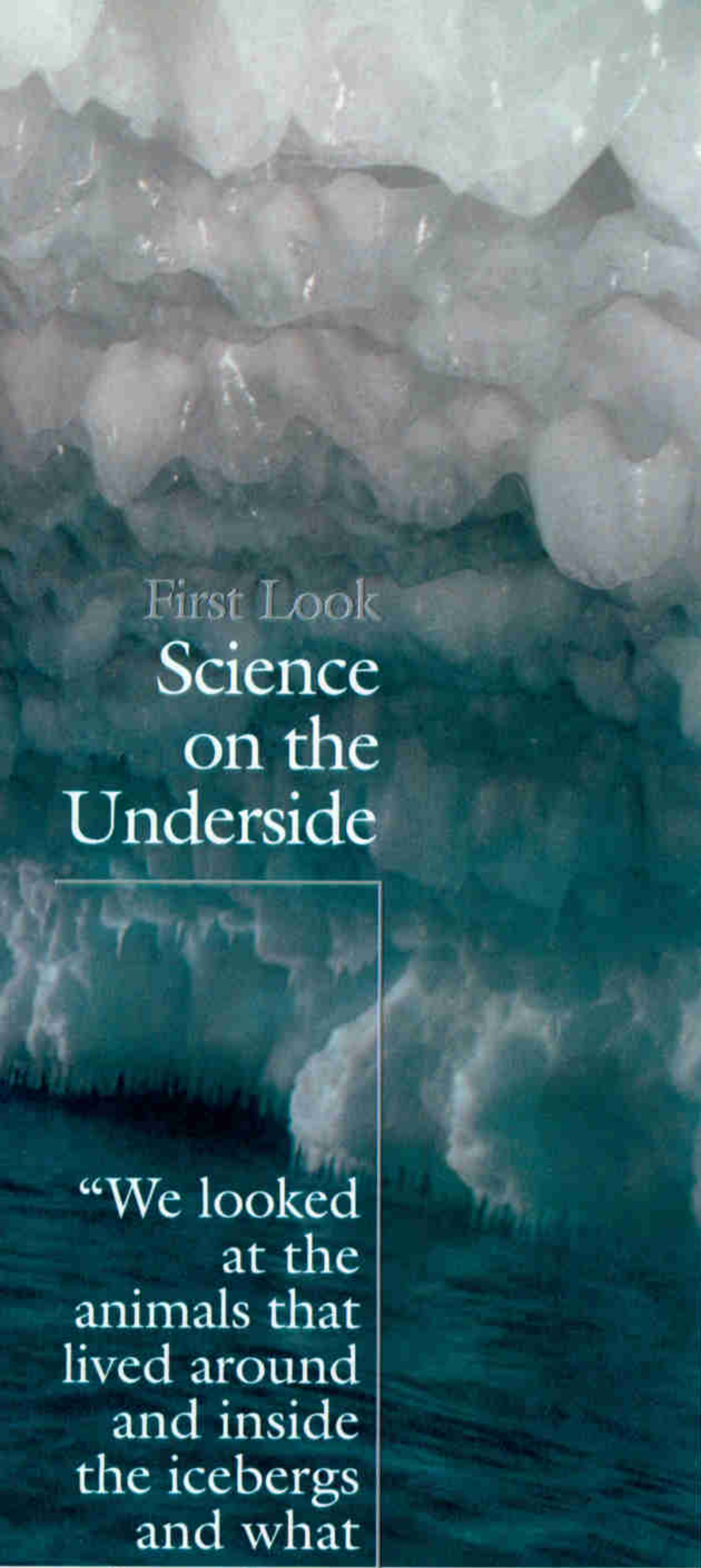
It took only a month after B-15 was born for photographer Wes Skiles and me to decide to launch an expedition to study it. Antarctica's large, tabular bergs create habitat for penguins and seals that climb on ice ledges at the waterline and for seabirds that roost on them. At their edges

"An absolutely nice day." Wes Skiles recalls a moment when he caught *Braveheart's* bow crashing into a wall of wave. Winds often blew at gale force. The ship once rolled 40 degrees but came back up—as did, now and again, a lot of the crew's meals.



A swell surging under his inflatable boat nearly propels author Gregory Stone into the jagged roof of an iceberg's cave and interrupts data gathering. The team saw killer whales that may be a new species, smaller than typical and with unique markings.

PORTER TURNBULL



First Look Science on the Underside

“We looked
at the
animals that
lived around
and inside
the icebergs
and what
those large
chunks of
ice did to the
surrounding
ocean.”

—Gregory Stone

and in caves that form along them, nutrients mix and fuel the growth of tiny marine plants called phytoplankton, the basis of the marine food web. As they drift and melt, the bergs leave physical and biological wakes that may encourage the concentration of krill, fish, jellyfish, whales, and seals.

In the months after B-15 calved, its fragments appeared headed for the shipping lanes supplying McMurdo Station, where the U.S. Antarctic Program operates year-round. And B-15A, the largest remnant of B-15, was positioned in a way that impeded more than 170,000 breeding pairs of emperor and Adélie penguins from traveling back and forth to their rookery at Cape Crozier.

We recruited an 18-member team of divers, environmental scientists, and a rough-and-ready New Zealand crew, and on January 17, 2001, in the 129-foot steel-hulled *Braveheart*, we set sail from Lyttelton, New Zealand. More than 2,000 miles and two weeks later (the equivalent of traveling from Miami to Los Angeles at seven miles an hour through gale-whipped ocean) we reached the remote, ice-choked waters of the Ross Sea.

In the end an unusually bad season of pack ice kept us from reaching B-15B in *Braveheart*. But for the five of us who dived some 90 times into the frigid waters, the bergs that littered the Ross Sea—many of them smaller chunks of B-15—provided more than seven weeks of science, exploration, and adventure.

We wanted to explore underwater places too dangerous for open-circuit scuba gear, so we used state-of-the-art rebreathing equipment that allows divers to remain safely at greater depths for longer periods by recycling exhaled breath. The water temperature presented separate problems. Seawater at 29.5°F sucks away

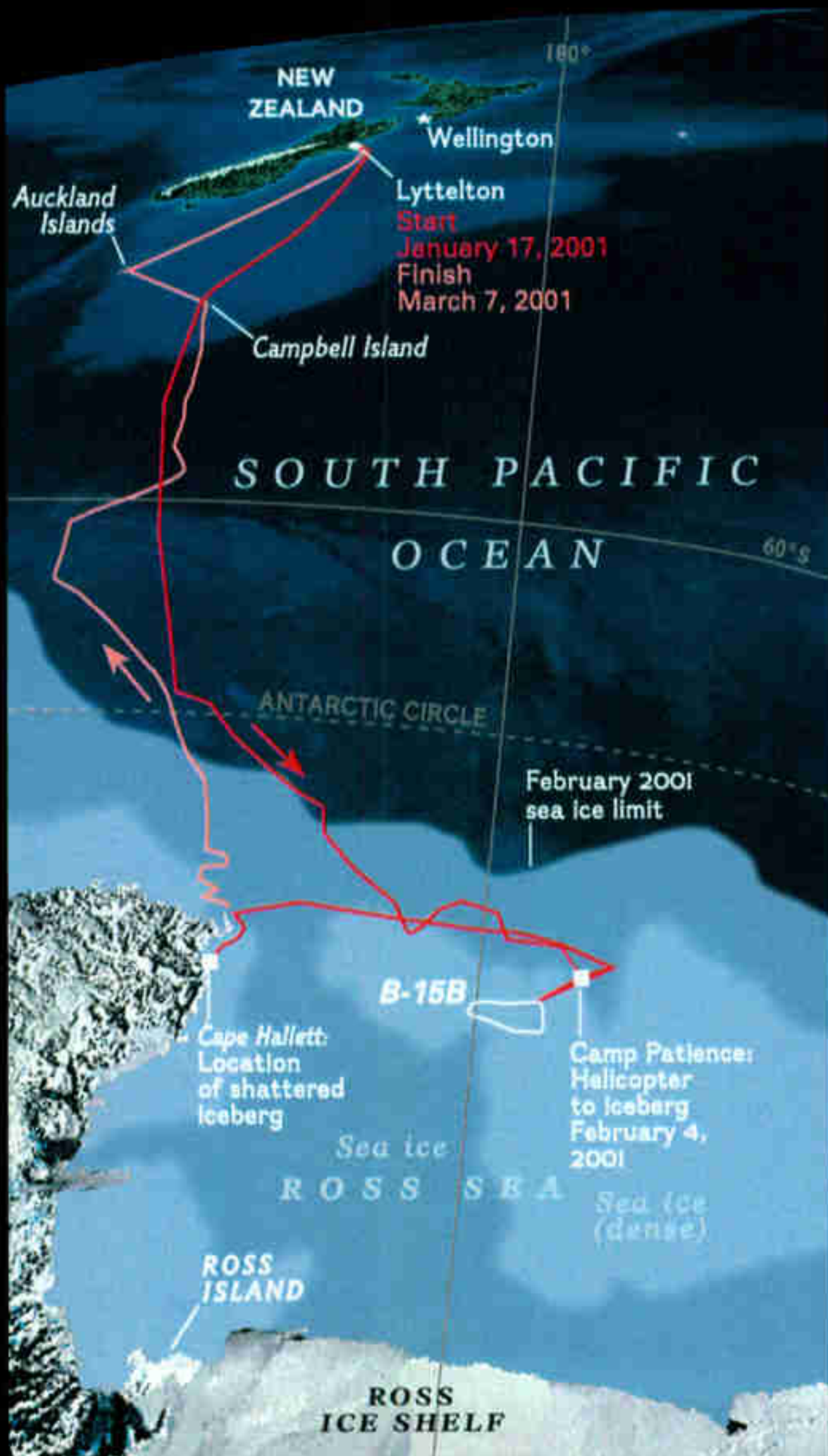
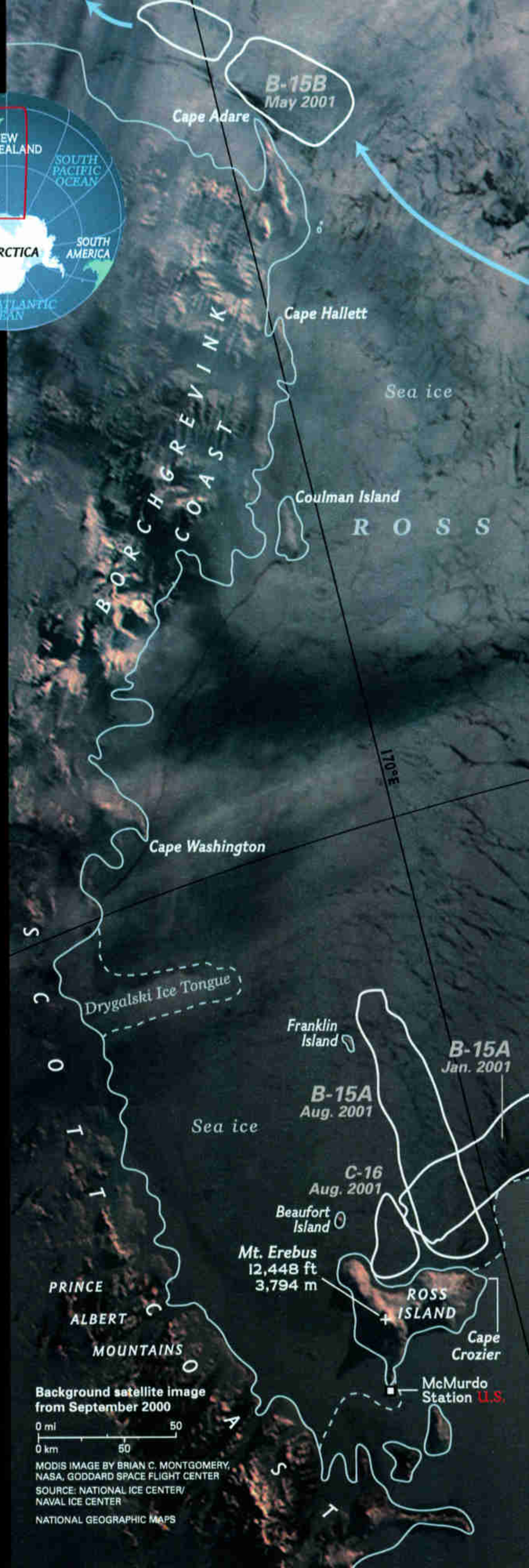
body heat so quickly that a naked person would die in minutes. We wore two layers of underwear, dry suits, electric heaters, and two hoods. Still, most of the time in the water our hands and feet throbbed with pain. It took several months after returning home for some of us to recover complete feeling in faces, fingers, and toes.

Although the symptoms of frostbite and neuralgia have faded, the wonder of the expedition has not. Our observations support the research that indicates Antarctica's monstrous bergs, some of which can last for years, are a major factor in the biology of the Ross Sea. As they calve, move, and melt, they play an important role in the operation of the entire global ocean system. That system covers 70 percent of Earth, and what we are learning in Antarctic waters will fundamentally affect what we know about the future of our planet.

Ice Islands

Giant Bergs Adrift

On March 17, 2000, a satellite recorded a rare event at the edge of Antarctica's Ross Ice Shelf, a dynamic feature almost as big as Texas and as flat as a frozen pond. A gigantic iceberg, given the homely official name B-15, was separating from the shelf and moving offshore. How to inspect it in that frigid expanse of hostile solitude? A team of scientists and divers, a boat crew, a helicopter pilot, and others funded in part by NATIONAL GEOGRAPHIC put out from New Zealand. In January 2001 they sailed south to study B-15, which had broken into fragments, and to assess the physical and biological effects of those and other icebergs floating in the Ross Sea.



Scale varies in this perspective. Lyttelton to Cape Hallett is 2,000 miles. IMAGE BY CARTOGRAPHIC APPLICATIONS LAB, JPL, NASA

6 May 2001

Having broken nearly in half, B-15B and its offspring pass Cape Adare. By August 2001, B-15B and smaller fragments are being swept westward by coastal currents.

5 February 2001

The small helicopter launched from the vessel *Braveheart* lands on B-15B (approximate position) for a brief exploration and survey study.

3 September 2000

Icebergs block the northward movement of sea ice, creating open water on their leeward side.

4 January 2001

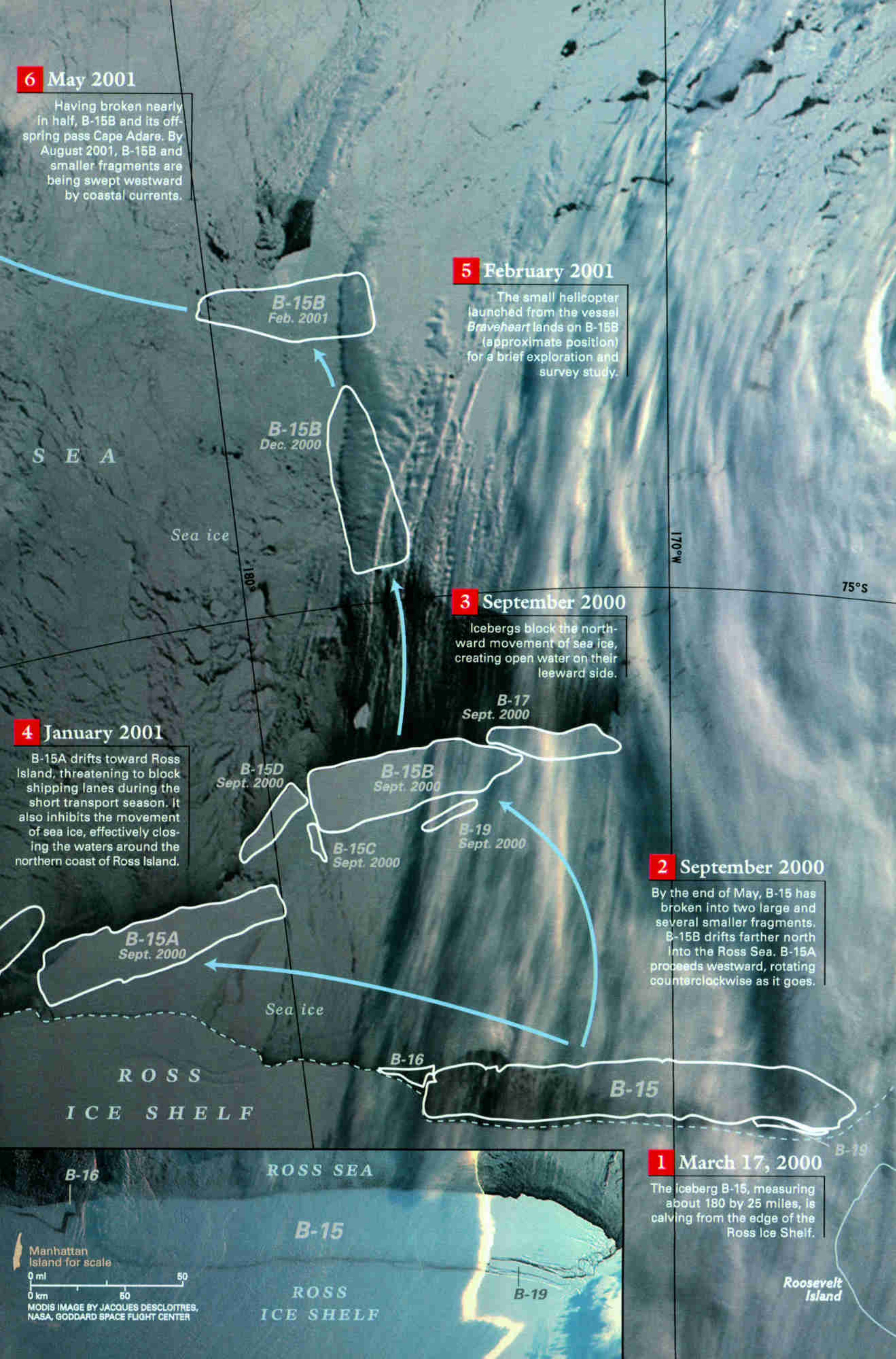
B-15A drifts toward Ross Island, threatening to block shipping lanes during the short transport season. It also inhibits the movement of sea ice, effectively closing the waters around the northern coast of Ross Island.

2 September 2000

By the end of May, B-15 has broken into two large and several smaller fragments. B-15B drifts farther north into the Ross Sea. B-15A proceeds westward, rotating counterclockwise as it goes.

1 March 17, 2000

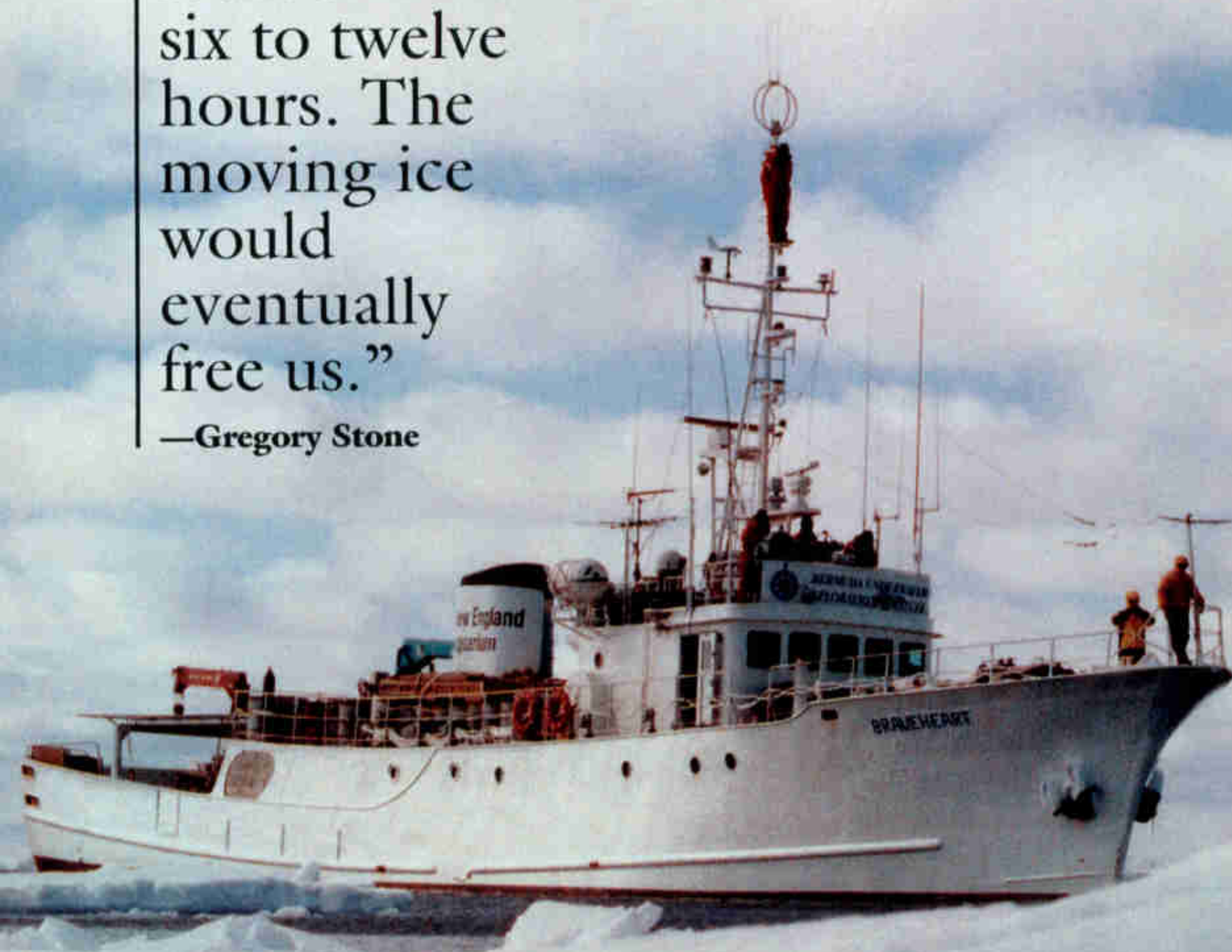
The iceberg B-15, measuring about 180 by 25 miles, is calving from the edge of the Ross Ice Shelf.



Ross Sea Icebound

“We were locked in for six to twelve hours. The moving ice would eventually free us.”

—Gregory Stone



JILL HEINERTH



PORTER TURNBULL





While plowing through the South Pacific Ocean on the way to Antarctica, the greatest ice danger to *Braveheart* was from freezing spray piling weight on the topsides and threatening the ship's stability. One remedy was to apply direct force (below left). "You go out there and club it to death," says Skiles.

Once closer to the continent, pack ice crowded around the ship. Crew members took turns at the bow (below middle) to advise the skipper if the vessel was coming into slushy thin ice, which was no problem, or into chunks two meters thick, which were. A small berg (below), named Camp Patience by the crew after one of explorer Ernest Shackleton's encampments 85 years before, was a convenient mooring to test ice-diving equipment. Gregory

Stone and fellow biologist Porter Turnbull made repeated dives—wearing scuba gear, \$500 quilted polypropylene and Thinsulate underwear, and heated dry suits—to collect animals such as jellyfish and krill, which traditional nets miss.

Pushed by currents, the berg and *Braveheart* drifted along together, making some 30 miles in a few days, as wind-driven sea ice floated by. Finally pack ice locked the ship tight 46 miles from its destination: iceberg B-15B. Skiles and pilot Laurie Prouting climbed aboard the ship's tough little helicopter to scout leads through the pack ice.

CARLOS OLAVARRIA



A photograph of a long, straight, white ice shelf extending into the ocean under a clear blue sky. The ice shelf is composed of many vertical ridges and grooves, suggesting it has been cut or broken apart. The water is dark blue and calm. The sky is a deep, clear blue.

B-15B
The Size of
Delaware

“The
moment we
first saw it,
we knew it
was B-15B.
It stretched
on into what
seemed
infinity.”

—Laurie Prouting

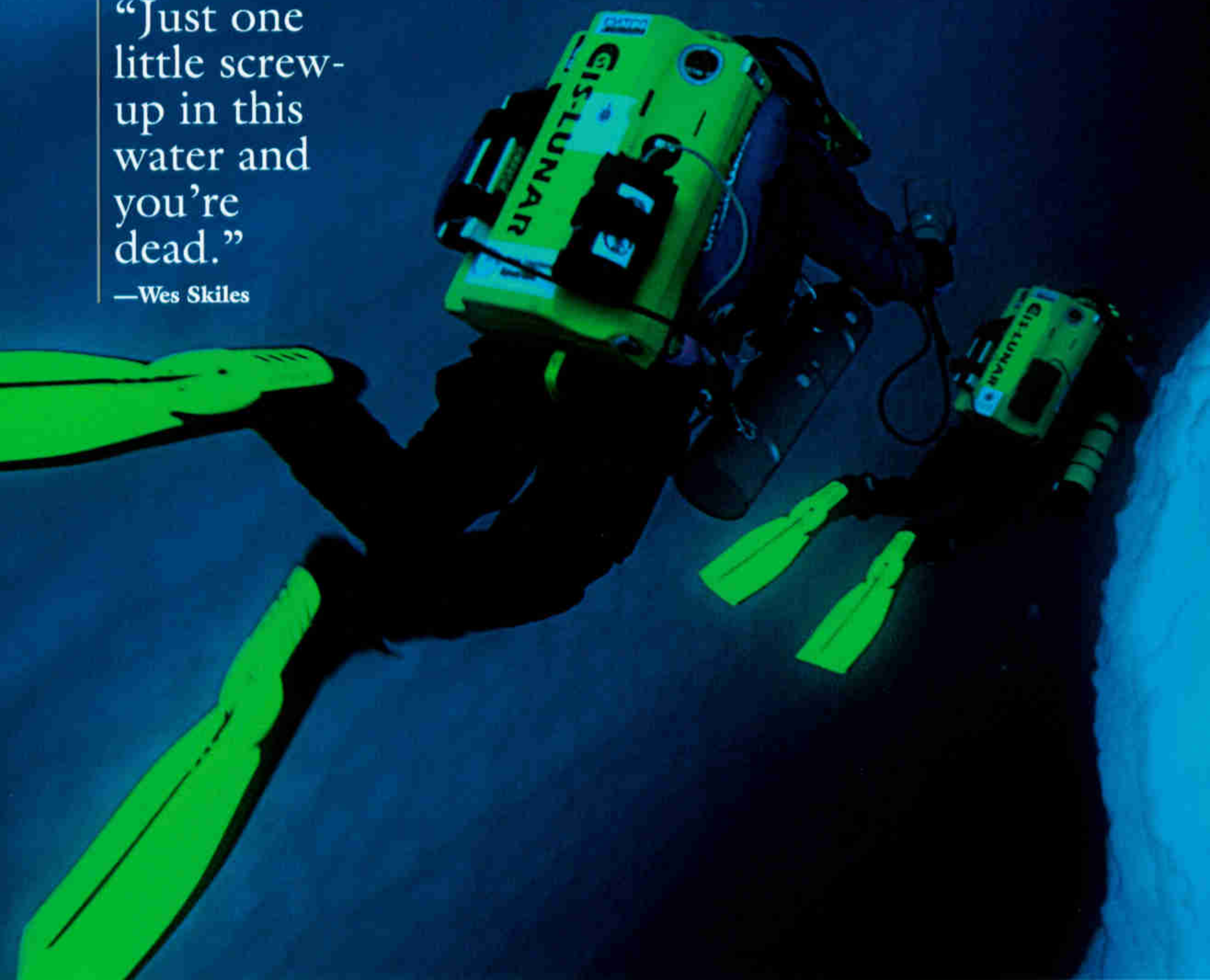


When the helicopter landed on the towering mass of B-15B, the engine was kept running. Skiles and Prouting made sorties to measure the 205-foot-high face, observe strong currents at the base, and survey the surface. When they took off, they left only footprints and skid marks behind.

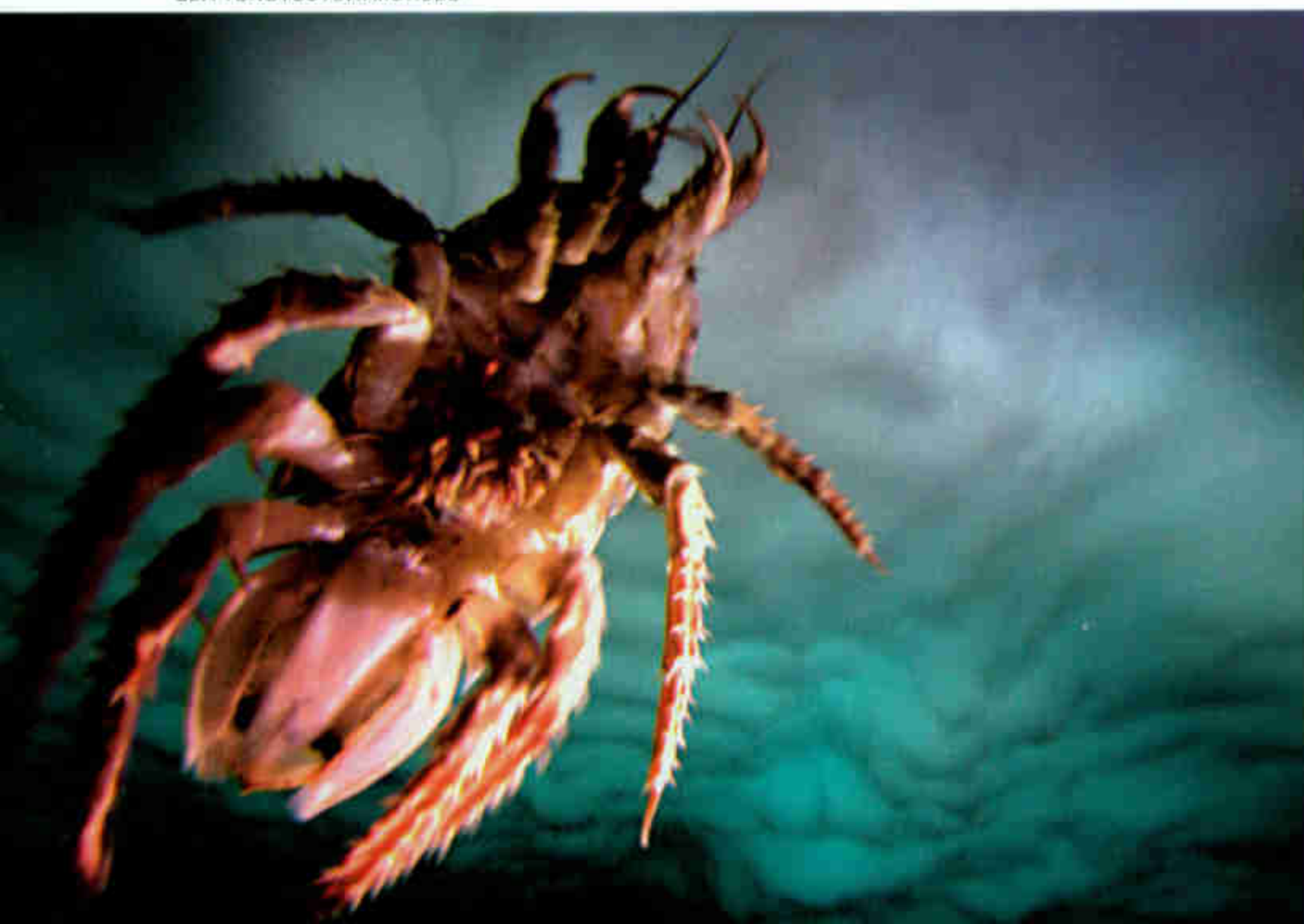
Cave Dive Into the Abyss

“Just one
little screw-
up in this
water and
you’re
dead.”

—Wes Skiles



GLYPTONOTUS ANTARCTICUS



POTAMILLA ANTARCTICA





An opening in an old iceberg grounded off Cape Hallett beckoned like an endless grotto. Jill and Paul Heinerth, both veteran exploration research divers, swam into it with Wes Skiles following. All wore advanced rebreathing gear, which recycles their exhalations, adding life-sustaining oxygen. Skiles: "This was definitely pioneer diving. We were staying longer at these depths than people ever thought about in this kind of water. We were filming and science sampling successfully because of the technology. That said, I hope I never have to make another series of dives that are so high risk." A thousand feet in and 130 feet down they came upon a garden of life. An alien-looking isopod (below left) about five inches long swam by. The bottom was rich with

feather duster worms (below middle) and sea cucumbers (below). While much of the seafloor had been scoured clean of life by icebergs bulldozing along the bottom, here the grounded berg had provided shelter. Their work done, the three divers attempted to swim out, but they were stopped by an adverse current. "Jill and Paul could make some forward progress, but I was getting swept back into the cave," Skiles recalls. Swimming shoulder to shoulder, they at last found a depth where the current eased. Making slow progress, they reached open water, overdue and to-the-bone cold—but safe. Four hours later the iceberg exploded.

ABYSSOCUCUMIS TURQUETI





Cape Hallett Gamble Pays Off

“After we had been around all these stable icebergs, it looked so

unnatural to suddenly see one begin crumbling.”

—Gregory Stone

As always when in the company of icebergs, *Braveheart* proceeded carefully, here above a submerged saddle connecting two ice masses. To maintain operational caution and satisfy scientific curiosity required a fine balance. The grounded iceberg off

the coast of Cape Hallett (right) that had sheltered undersea life for as long as five years shattered only hours after the divers had returned to *Braveheart* and the ship had moved away. The iceberg split apart, leaving one wall open to the sea and shards of ice

floating before it. The explosion—think of an ice cube cracking when dropped in tepid water—may have been the largest of its kind ever witnessed. Author Gregory Stone: “It was almost a lottery ticket coincidence that we would be there the night it decided to go.



Getting close to icebergs is dangerous; we know it's dangerous, but we took calculated risks to do this research." □

MORE ON OUR WEBSITE

Dive beneath an iceberg with photographer Wes Skiles and find more images at nationalgeographic.com/ngm/0112.

AOL Keyword: NatGeoMag





Big ideas often start in small—and computer-cluttered—spaces in California's Silicon Valley, still the top address for geniuses and entrepreneurs in the online

universe. Camped in a rented room in Belmont, south of San Francisco, the founders of FHP Wireless work late writing and testing software and plotting how to raise capital. They believe they have

developed technology to create inexpensive and easy-to-use wireless networks. In true Valley style, they believe they will change the world.

inside the

dream



silicon valley
incubator

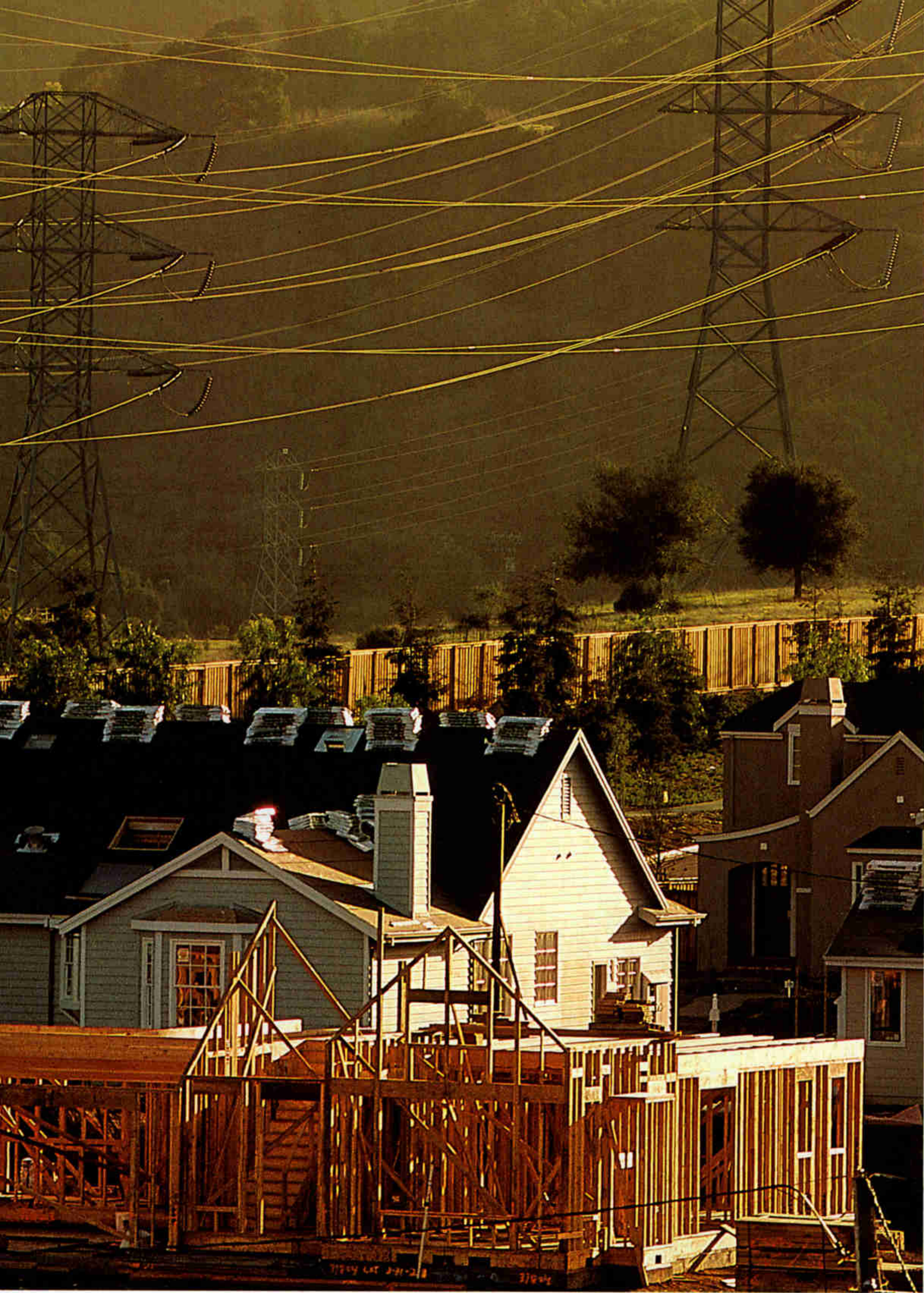
by cathy newman
NATIONAL GEOGRAPHIC SENIOR WRITER

photographs by bob sacha



BUILD

Million-dollar houses rose as fast as stock earnings in Silicon Valley during the technology-driven boom of the late 1990s. With the area's abundance of rich customers and shortage of lots, a developer in Cupertino could place



luxury homes near a power substation and still draw buyers. Modest houses in the Valley came with \$400,000 price tags. When the stock market fell last year, creating bankruptcies and layoffs, the housing market sobered up. For the first time in years sellers were accepting bids at or below asking price.

a

small earthquake hit Palo Alto my second day in town. The bedside lamp vibrated, nothing more, but it was a reminder that the San Andreas Fault snakes down this part of California.

Several days later Jim Calzia, a geologist with the U.S. Geological Survey, drove me out to see the San Andreas, which translates on the landscape as a low green trough. The Big One is predicted sometime in the next 30 years, Calzia said. It could be a 7 in magnitude: utterly catastrophic.

“So why do people still live here?” I asked.

Calzia barely suppressed a grin.

“How lucky do you feel?” he said.

Silicon Valley thrives on risk. Ever since 1933 when Frederick Terman, a professor of engineering at Stanford University, mentored two undergraduates named Bill Hewlett and Dave Packard, the Valley has been about placing bets on people, ideas, and inventions. Terman’s protégés would go on to found Hewlett-Packard, the Valley’s pioneer high-tech company.

Since then Silicon Valley has attracted the best and brightest from all over the world. It has as intellectual capital two great universities:

Stanford and the University of California at Berkeley. It is home base to a who’s who of technology and the incubator for hundreds of graduates seeking to emulate Hewlett and Packard. It was here that Pong, the first video game, went from dream to reality, as well as the ink-jet printer, the video recorder, the mouse, the personal computer, and much else we take for granted in the information age. The expertise of Silicon Valley has, in no small measure, wired the world.

At its high-flying peak in 2000, 43 of *Forbes* magazine’s 400 richest Americans lived here. Their wealth added up to an estimated 184 billion dollars, and if you believed the hype, 60 new millionaires were minted each day. Dot-com fever fueled the jackpot economy; secretaries cashed in options and drove off in Porsches.

But in the opening months of 2001 the headlines wept financial woe. The Nasdaq, the technology-heavy stock index, had plunged



more than 50 percent from its high a year earlier. Dot-coms foundered and sank. Even solid companies like Cisco, Intel, and Hewlett-Packard hoisted warning flags of workforce cuts and lower earnings. To add insult to injury, a power crisis had erupted in California. Blackouts stunned the state. You could build the fastest, smallest, most powerful computer, plug it in, and nothing happened.

Still the mood in the Valley registered optimistic, as if the water supply were fluoridated with Prozac. “We call it techno-optimism,” said Jan English-Lueck, a professor of anthropology at San Jose State. “There’s an addiction to opportunity, and if you don’t see it that way, why are you even here?”

Silicon Valley is not a piece of official geography but a nickname for a 1,500-square-mile piece of northern California that runs from the outskirts of San Francisco south through Santa Clara County. It is an extended suburb of flat monotony, except for the expensive green idyll of residential areas such as Portola Valley and the grandeur of Stanford. Silicon Valley is an interior geography, a terrain made visible by grace of fluorescent and halogen light, connected by concrete tentacles of freeway.

“What would you show someone who came to visit Silicon Valley?” Chuck Darrah, a professor of anthropology, and his colleagues at San Jose State asked in a study of Valley families. “Yosemite, Monterey Aquarium, and Lake Tahoe,” they’d respond. “Yes, but they aren’t *in* Silicon Valley,” Darrah would point out.

There is the weather, which for much of the year consists of unbroken blue sky and moderate temperatures. The relaxed lifestyle has made khakis and a shirt the business uniform of choice. The live-and-let-live mind-set means anything goes. You are free to dye your hair blue, be openly gay, bare your navel ring at work, start a multimillion-dollar company. No one bats an eyelash.

Two years ago Marcia Babiak was a math teacher in northern Illinois, until a trip to California for a teacher’s conference changed her life. “Driving from the airport, I saw Candlestick Park, the Pacific Ocean, and fell in love with the place,” she said. “Three weeks later I moved here.”

Now she teaches at Mountain View High School. “I’m never going back,” she burred. “I love the place, I love the school, I love the kids.”

“What don’t you like here?” I asked.

“The living expense,” she replied. She makes \$48,000 a year, but after paying \$1,150 a month for an apartment smaller than her classroom and everything else a 28-year-old requires, she has no savings.

“What do you like about living here?”

“The freedom to be who I am.”

“Think Florence with numbers,” Morton Grosser, a consulting scientist based in Palo Alto, had said by way of explaining Silicon Valley. Instead of painters and sculptors, the Valley has geeks and nerds, and they are as passionate about circuitry as Michelangelo was about marble.

A computer whiz said he built an Altair 8800, one of the first do-it-yourself computer kits, because “it was cool and I wanted one.”

Les Vadasz, an executive vice president at Intel, said that for an engineer the excitement is the project. “You know that what you are



CHANGE

Corridors and cubicles may replace rows of sweet corn at Spina Farms near San Jose, where Mexican hands harvest one of the last rural plots in Silicon Valley. “It’s zoned industrial,” says John Spina. “My crops can’t come near to what a high-tech company brings for the tax base.” Fawad Ahmed, a technician from Pakistan, dons an anticontaminant suit at Intel’s Santa Clara facility to make the Valley’s most famous product—the silicon computer chip.



person, this atmosphere makes you want to jump in and conquer.”

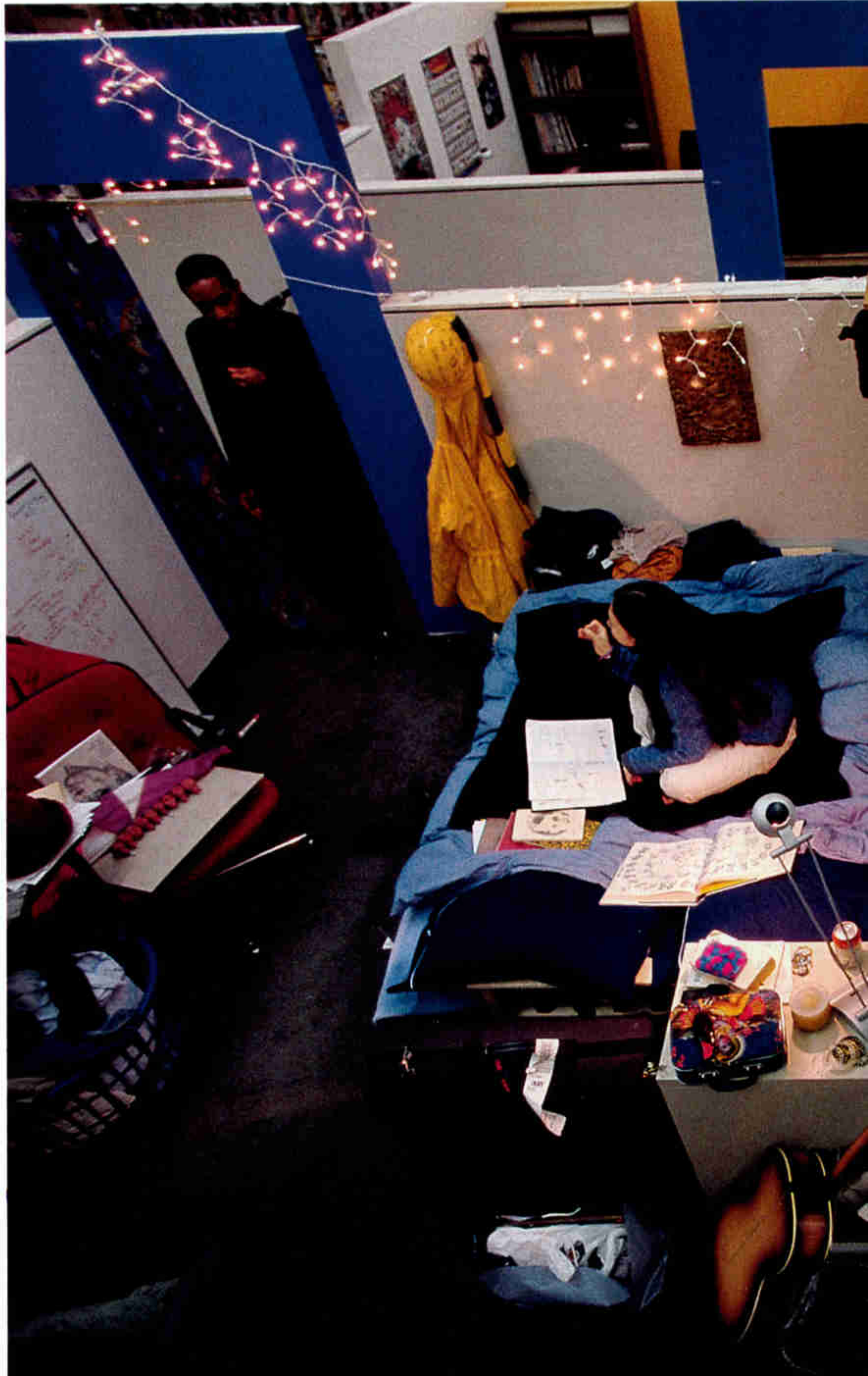
Long hours and immersion in her work persuaded project coordinator Julie Chin to set up house in her cubicle at There, a start-up still in “deep stealth” mode. Most of its offices come with futons for catch-up sleep.

Informal and intense, the Silicon Valley work environment redefines where and how people work. A backyard patio in Palo Alto doubles as a conference room for engineers with Narrow Band Audio, a start-up enterprise to deliver high-quality music to

WORK

always open
for business

cell phones. The close-knit dedication of many start-up employees often stems from school ties. “We were suffering together as graduate students in computer science at Stanford University,” says Narrow Band Audio CEO Anna Patterson. “I guess we decided to keep suffering together after Stanford. Seriously, if you are a competitive



**“WE CALL IT TECHNO-OPTIMISM.
THERE’S AN ADDICTION TO
OPPORTUNITY, AND IF YOU DON’T SEE IT
THAT WAY, WHY ARE YOU EVEN HERE?”**

JAN ENGLISH-LUECK, ANTHROPOLOGIST





CONNECT

A highway of cables links routers and servers at Equinix Internet Business Exchange in San Jose. Companies with equipment at the exchange can access networks serving 85 percent of the world's Internet routes. The human face of the Web thrives in San Francisco, where designers Ted Terbo Lizard and Amy Franceschini hang at Amy's Futurefarmers office. At CELLspace, an artists' haven, performers hope to lure folks away from computer screens.

working on is ahead of the curve, ahead of everyone else. It's a sport. A game."

In his living room overlooking San Francisco Bay, Roger O'Neill showed me a metal box the size of a hatbox. O'Neill, a biochemist, is vice president of research and development at a small company called Guava Technologies. The box, he explained, is a type of flow cytometer. Simply put, it peeks inside a cell to see what's going on: to discern how, for example, a cell is reacting to a certain antibiotic. The instrument is not new, but because of the technology this particular model is one-twentieth the size of its competitors and more affordable, he said.

Explain the kick, I asked. He walked me over to a shelf over the mantle. "My grandfather and father built model trains," he said. He showed me a locomotive and cars. The detailing was exquisite—from the planks on the siding of the boxcars to the wheel spokes on the locomotive, and it was all made by hand. "This was something they did purely for the joy of creating," he said. "It's not necessarily designing something from scratch that thrills me. For me the thrill comes from innovating within a basic design and making something beautifully that performs its purpose."



Silicon Valleyspeak has its roots in the language of business and engineering. You *maximize your child's skill set*, and if he plays in three different basketball leagues (as some do), there is *value added* in that his teammates' parents may turn out to be CEOs of companies you might be interested in. Vacation is *downtime*, but hardly anyone leaves a cell phone or handheld at home.

VCs are venture capitalists, the financiers of Silicon Valley. They round up the capital—from pension funds, wealthy individuals, and



universities—needed to underwrite a fledgling company. Last year venture capitalists in the Valley invested an estimated 17 billion dollars in new companies, known as start-ups.

Why not go to a banker? I asked Morton Grosser. Grosser is a start-up investor and technology adviser to many VC firms, including Kleiner Perkins Caufield & Byers, one of the biggest, so we meet for lunch at a Menlo Park café called the Left Bank for a lesson in Venture Capitalism 101.

“Bankers are to the right of Herbert Hoover,” he explained. “Most of those guys have never risked a toothbrush. Take five 27-year-old graduate students with a great idea. They’re going to get on their knees in front of the president of a bank? They’re going to have collateral?”

VCs, who take a cut of the company and a seat on the board as their pay, couldn’t care less about collateral. They lay out money for what a conservative institution would regard as unacceptable risk.

“I went to Paris, on invitation of the government,” Grosser said. “They wanted to know how to have a Silicon Valley in France. So you have a glass of red wine with the bankers and

hear them grumble: ‘Kids these days don’t know how to work. These kids don’t know anything. So what do you do to create a Silicon Valley?’ the bankers finally ask.

“It’s simple, I tell them. You have to have a good technical education, financial training, and you have to have worked for a real company. Many VCs in Silicon Valley have started their own companies by the time they are 38.

“And, you have to be willing to listen to a group of twentysomething-year-olds.”

His eyes danced. “They go pale. ‘You don’t understand. It’s not so easy,’ they sputter. And greed plays a part,” he said. “They want a Silicon Valley too. But they are so traditional, they can’t do what needs to be done.”

He was talking about cultural arteriosclerosis, an Old World hierarchy that stifles the freewheeling entrepreneurial spirit that fuels Silicon Valley. The kind of spirit that prompted Bill Hewlett to answer the phone and listen to a 12-year-old named Steve Jobs who had called to ask for some parts for a piece of electronics he was building. Hewlett later hired Jobs, who would go on to found Apple Computers.

“Great cities are born because of the discovery of gold or oil or because of geography

and the location of a port," Grosser said. "The natural resource here is brains."

Despite the intellectual firepower of the Valley, I kept feeling a nagging sense of something not quite right, a subterranean rumble of something I couldn't put words to.

Maybe it was the dozens of Mercedes and BMWs in the student parking lot of Palo Alto High School, knowing the principal drives a 1991 gray Nissan truck. Or hearing one too many stories about the guy with a Mercedes and four-bedroom home who crybabled because he hadn't cashed in on the dot-com boom like his zillionaire buddies. Perhaps it was the 25-year-old who worked at Yahoo! who, when I expressed the hope my 15-year-old son would always know his way around a library, told me with faint disdain I should stop treating books like fetishes.

Maybe it was standing under the trees at the Drop-In Center run by the Urban Ministry in downtown Palo Alto, where homeless men and women turn up each morning for a cup of

coffee directly opposite Stanford University and the high-end stores in the Stanford Shopping Center.

Besides providing a list of resources ("Where to take a shower," "Where to get medical help"), volunteers hand out 20 bus tickets each day, first come, first served.

"The bus tickets are very important to these men," Sergio Samame, a caseworker, explained, as a line formed under the shade of a metal overhang.

"Why?" I asked.

"They have nowhere to sleep. So they ride the bus all night."

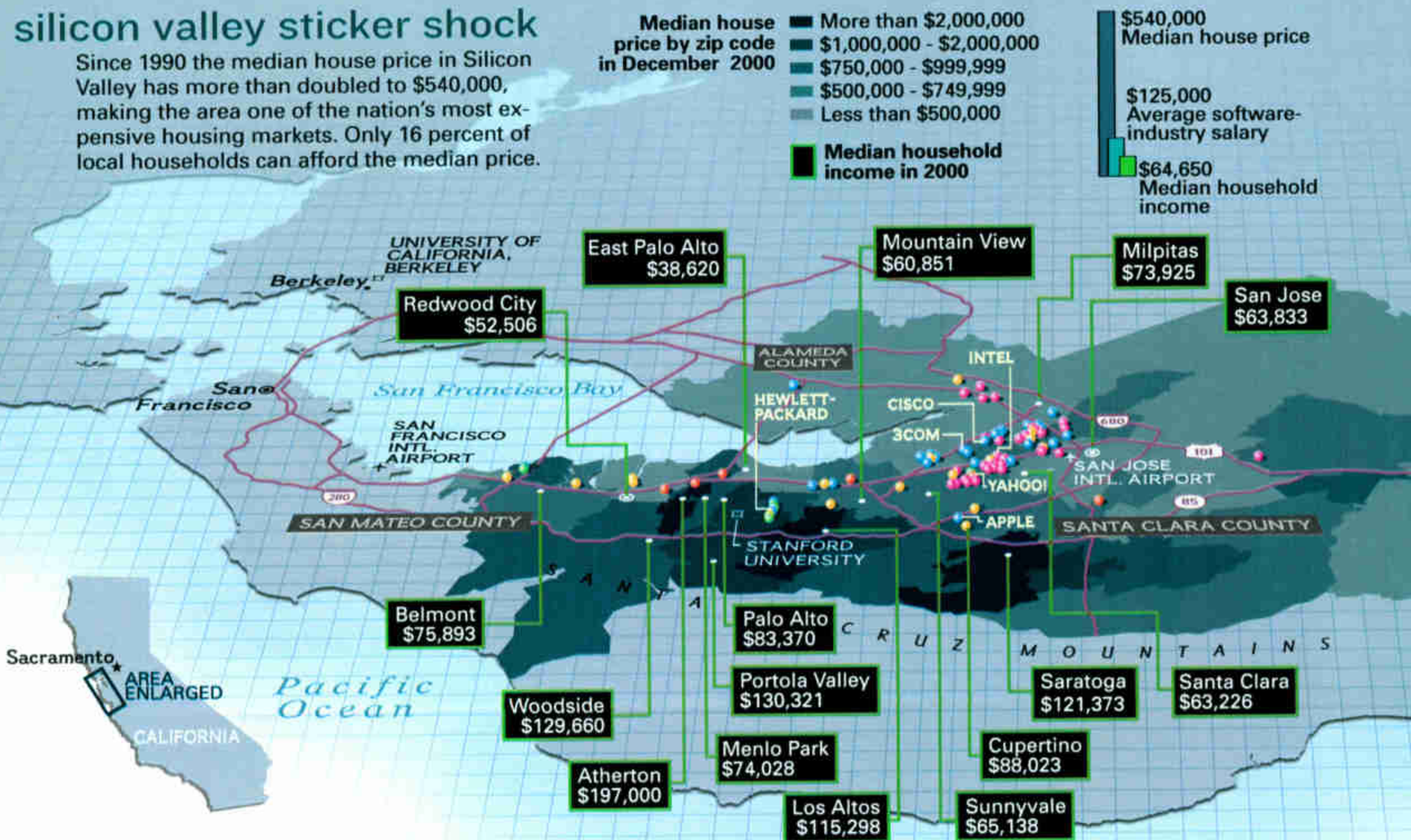
gentlemen, ladies. Attention please. Palm Pilots in hand? Business cards in reach? Ready? Set? We are going to *network*.

Rule number one. Opportunity surrounds you.

A meal with friends? Heads up. Case the room. Isn't that *Steve Jobs* at the next table?

silicon valley sticker shock

Since 1990 the median house price in Silicon Valley has more than doubled to \$540,000, making the area one of the nation's most expensive housing markets. Only 16 percent of local households can afford the median price.



Your daughter's school play? Why not? CEOs have daughters too.

Visit the University Café in Palo Alto, Buck's in Woodside, or Il Fornaio in San Jose. Look around. See the two guys at that table? The kid who looks like a high school sophomore is hoping to do a start-up. The older guy is a venture capitalist. They are *cutting a deal*. The group of twentysomethings in the corner drawing on a legal pad? They are devising a business plan. Your turn. Pull out your cell phone. Establish that you too are a player.

"There was a fellow from France working here," recalls Chuck Darrah, the anthropology professor at San Jose State. "He said that in France you would never talk about work in a social context. You'd never ask people what they do. It just isn't done. When this guy got promoted, he invited all the people who worked for him to a barbecue in his backyard."

Mon dieu! Midway through the party everyone had their business cards out. The host was

appalled. Failure! He wanted to run around and grab every card and fling them into the fire. He paused. The light clicked on. It's normal! That's what everyone does here!

"Everyone," Darrah said, "is perpetually on the make."

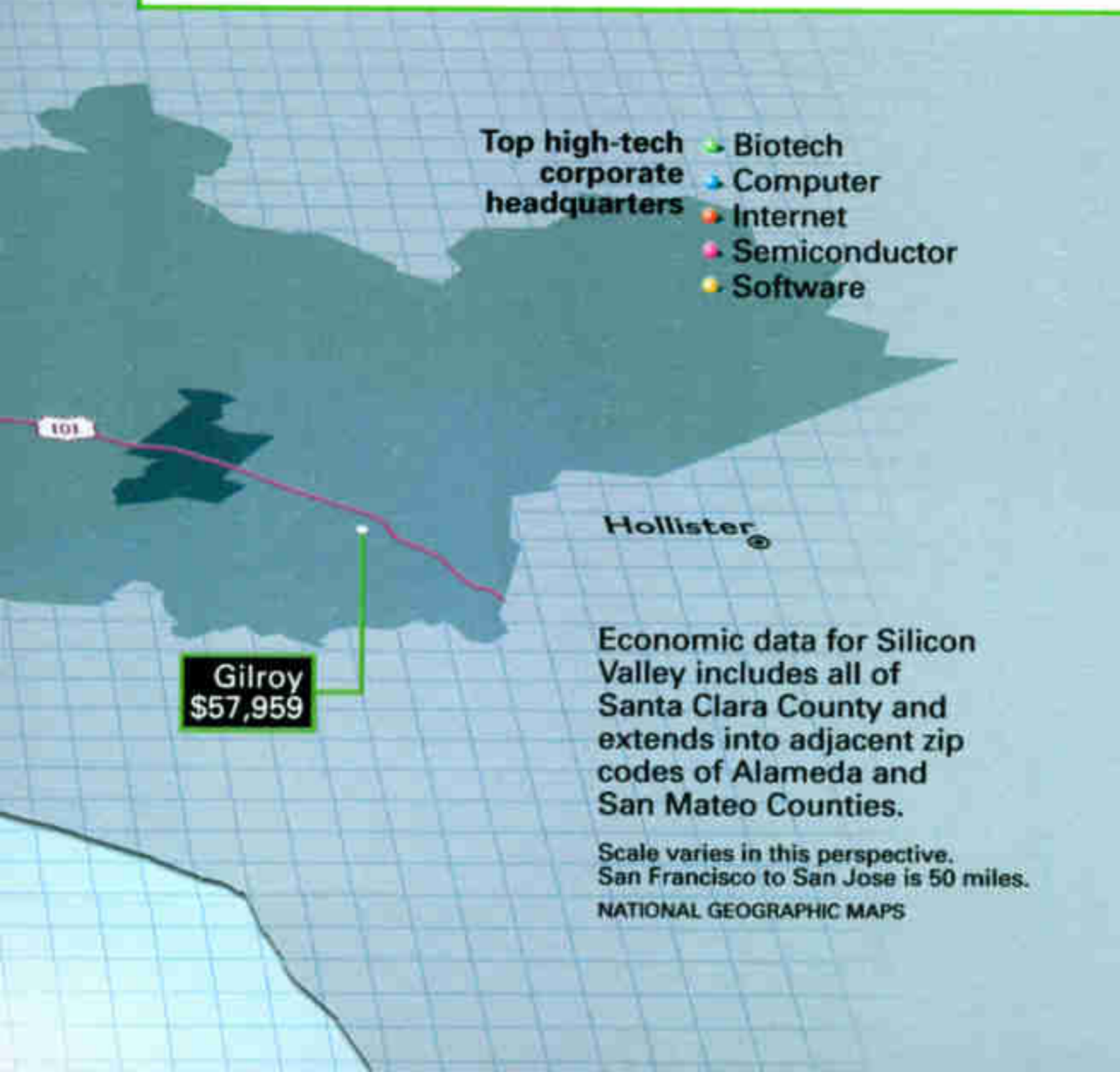
In Silicon Valley money is, with few exceptions, not inherited. It is earned, either by invention of a brilliant idea or, sometimes, by the clever marketing of a mediocre one.

"When people make money, the first thing they want is a really nice house," said Paul Conrado, a high-end contractor based in Saratoga. His job is to build them those really nice houses. "Ego builds some of these homes," he said, as we took off to see his work. "I have 12 houses going at the moment. The lowest is going to cost a million and a half, the highest is over four million, and that's not including the cost of the land. Eleven clients are paying cash."



MOVE

Glowing with industry and wealth, Silicon Valley, viewed from the Santa Cruz Mountains, increasingly becomes more a work destination than a home neighborhood as middle-income employees seek affordable housing farther and farther away. Single mother of four children, Kay Wiley leaves before dawn to drive 65 miles to a software firm. She eventually switched to a job closer to her home in Hollister because "I missed waking up my children."



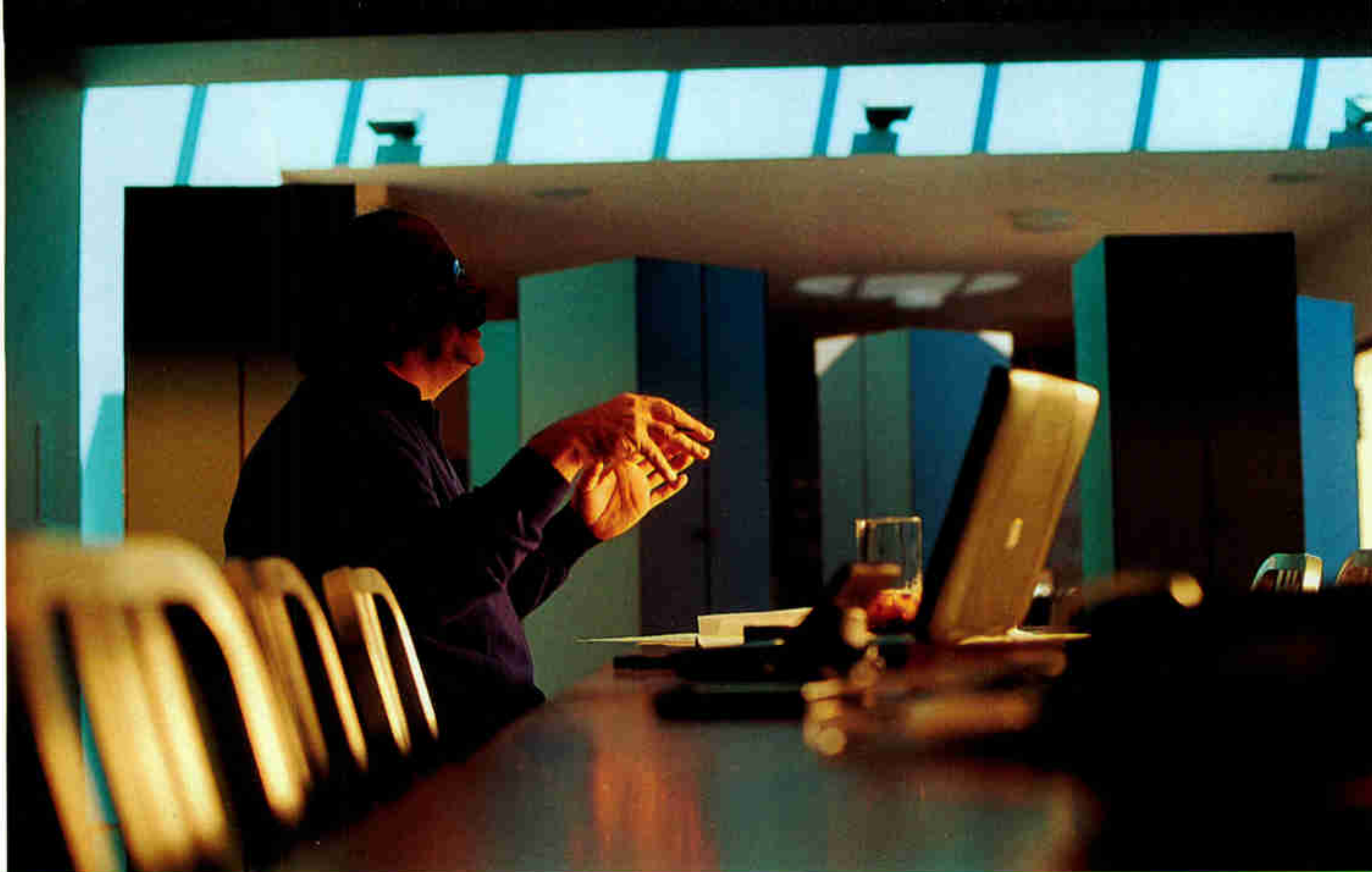


ESCAPE

Guests shed shoes and stress when they advance into the heart of Cevan Forristt's sculpted garden at his home in downtown San Jose. Celebrating Songkran, the Thai New Year, Forristt, a landscape designer who looks



to Asia for inspiration, pours champagne and savors his oasis. "In Silicon Valley, where everything is new and everything is trendy and transitory, I want to make gardens that look like they've been there forever," he says. "They should be retreats where people go to get healthy."



THINK

Maestro of design, David Kelley (above) traces his success as an innovator—he designed Apple’s first computer mouse and other inventions at the IDEO firm—to his training at Stanford University. What Kelley calls a “focus on the creative leap” led students Bob Schafer, sitting in his dorm with his girlfriend, and Adam Grunfeld, standing, to devise a textbook auction site on the Web. Touch football on the Palo Alto campus (below) hones the competitive spirit.

“We’re also building a thousand-square-foot barn costing \$400,000,” he added, casually.

Marble floors? A herd of horses?

“No, just two horses,” he said. “It’s a high-tech barn with automatic watering troughs; things like that cost a lot.”

The centerpiece of a Conrado house is a vineyard. “In high-end houses, having a vineyard is like having a Mercedes in the driveway,” he said. “You look out of your window at your vines while you drink wine from your own backyard.”

We pulled up to a 9,000-square-foot Mediterranean style home he’d built on a lot at the edge of Palo Alto just before it lifts into the foothills. The owner walked me through the house, which had a 12-seat movie theater and 1,200-bottle wine cellar. In the backyard a custom-built stream tumbled down a series of rocks to end in a pond, home to koi and a turtle—a nice vista for the guesthouse, which had a wood beam ceiling and its own kitchen.

As we pulled out of the driveway, the conversation drifted to the subject of big money and bigger money. Conrado mentioned one client worth 500 million dollars. “I can understand



what 5 million dollars is,” Conrado said. “I have a hard time understanding 500 million dollars. Of course, now that his options have dropped in value, he’s only worth 30 million.”

Had he been envious?

“It took me a long time not to go home and say: What’s my problem? How come I didn’t rise to that level? Then I realized money can’t buy your way out of most of life’s miseries. In this area your home is very important to you. That is probably why we build so many homes that feel like stages. People want to make a statement; their home is how they do it.”



“YOU KNOW THAT WHAT YOU ARE WORKING ON IS AHEAD OF THE CURVE, AHEAD OF EVERYONE ELSE. IT’S A SPORT. A GAME.”

LES VADASZ, INTEL EXECUTIVE

melita Singh would be happy if she could find a home, any home, to rent, but for now she, her husband, and their three children will have to get by in a room in the Boccardo Reception Center, a shelter for the homeless in San Jose.

The Singhs are not poor. Mrs. Singh, who grew up in Trinidad, is a registered nurse who works in a nursing home. Mr. Singh works on contract for Hewlett-Packard. Between them, they have an income of \$105,000.

But \$105,000 a year isn't house-buying money

in Silicon Valley, and the Singhs have the black mark of an eviction notice against them because of their noisy children. “You can throw money after scarce apartments all you want, but with an eviction you're not getting anything,” said Maury Kendall of the Emergency Housing Consortium. So the Singhs are part of a new trend in homelessness. “It's no longer hobos and bums. It's working people—moms and dads impacted by the economic boom.”

It is also a quirk of geography compounded by economics. The math is simple. The median apartment rental price is \$1,600. There is a

5 percent vacancy rate in Silicon Valley. Rentals are at a premium; landlords rule.

“Why should a landlord have to contend with pets or kids when there are plenty of renters without such liabilities?” Kendall asked rhetorically. “We are reaping the harvest of years of poor planning. There is no affordable housing because it doesn’t exist.”

Yet, there was optimism from Mrs. Singh. “I see this as the land of opportunity,” she effused, showing me their small room with pale yellow walls, tired gray carpet, and two double beds. She was feeding the baby, while three-year-old Josiah tugged at her shirt and five-year-old John bounced on the bed.

“I tell you why I came to America,” she said. “In my country it’s so limited. I love America. Land of opportunity. All will work out.” She lay back on the bed and laughed.

Some don’t even have the luxury of a heated room with access to a bath. “We have clients who come through the door who live in garages,” Toni Wallace said. “They pay \$500 to \$600 a month for a garage with no toilet. Sometimes the space isn’t insulated, let alone

“It used to be you could go home at the end of the day and feel you helped someone. Now you just don’t know,” Wallace said.

“What do you do then?” I asked.

“We fall down, and we get back up.”

The dot-com market had been in free fall, and at 550 Montgomery Street in San Francisco’s financial district you could pick through two floors of computer equipment and office furnishings from a defunct company called Stockpower.com to be auctioned the next day. Lee Harris, a businessman, looked at computers. He’d bought desks and cabinets at previous auctions, where, for example, a \$60,000 server had sold for \$5,000. “The buyers were jumping up and down,” he said. “It’s top quality stuff. Herman Miller chairs and office partitions that they practically pay you to take away.” His eyes lit up. “There’s a Mac!” he said, and left to inspect lot #1143 Apple Power Mac G3 with 4GB HDD.

Another dot-com ship had sunk. The flot-sam and jetsam would go to the highest bidder.

INVEST

Hard questions and tough advice strengthen Katarina Bonde (below) as she practices a fund-raising pitch at an event sponsored by the Forum for Women Entrepreneurs in San Francisco. Chief executive officer of Glides Inc., a Seattle



heated.” Wallace is director of a social services center in East Palo Alto, the predominantly Hispanic and African-American city separated by a highway from its more affluent neighbor, Palo Alto.

Were things getting better?

“No,” she replied. As electric bills soared, things were getting worse.

By late summer the *Industry Standard*, a magazine covering the Internet world, listed 139,643 dot-com layoffs since December 1999, then went belly-up itself.

What went wrong? “A lot of start-up companies should never have been funded,” Karae Lisle said. She’s a business consultant in Menlo Park and den mother to a support group for CEOs of companies in trouble. “The venture capitalists threw money at companies like they were slot machines. Pets.com? Like you’re going to shove a 30-pound bag of dog food through the mail slot to me? What were they thinking?”

Standard business principles evaporated. “Every one of these kids was right out of business school,” Lisle continued. “If someone gave you a pair of cleats, a bat, and a glove, and you only played catch with your dad and never dropped a ball, what makes you think you can play the World Series?”

“Do you know, Dave, your company is

valued at 20 times Goodyear?" Curtis Heinz, a San Francisco stock trader, told a friend whose dot-com had skyrocketed.

"So who needs tires?" his friend replied.

Reports of the demise of Silicon Valley were premature. The patient wasn't moribund, merely temporarily indisposed.

"Every time Silicon Valley goes through a cycle, people say it's doomed," said AnnaLee Saxenian, a Berkeley professor of regional planning. "In 1980 I myself argued that housing and labor were too expensive, roads too crowded, that growth would shift elsewhere. Later they said it again, with the rise of technological Japan. But there are real companies here. It would be hard to argue that the Internet won't be an arena for business. It's a question of who survives. Silicon Valley is not the traditional model. There are social intangibles. It's not just dollars and cents."

In Silicon Valley the bust was not failure; it was part of the learning curve. "It's okay to fail nobly," explained Tom Melcher, who is in the middle of a start-up. "It's one of the bed-rock things that make this place different. In

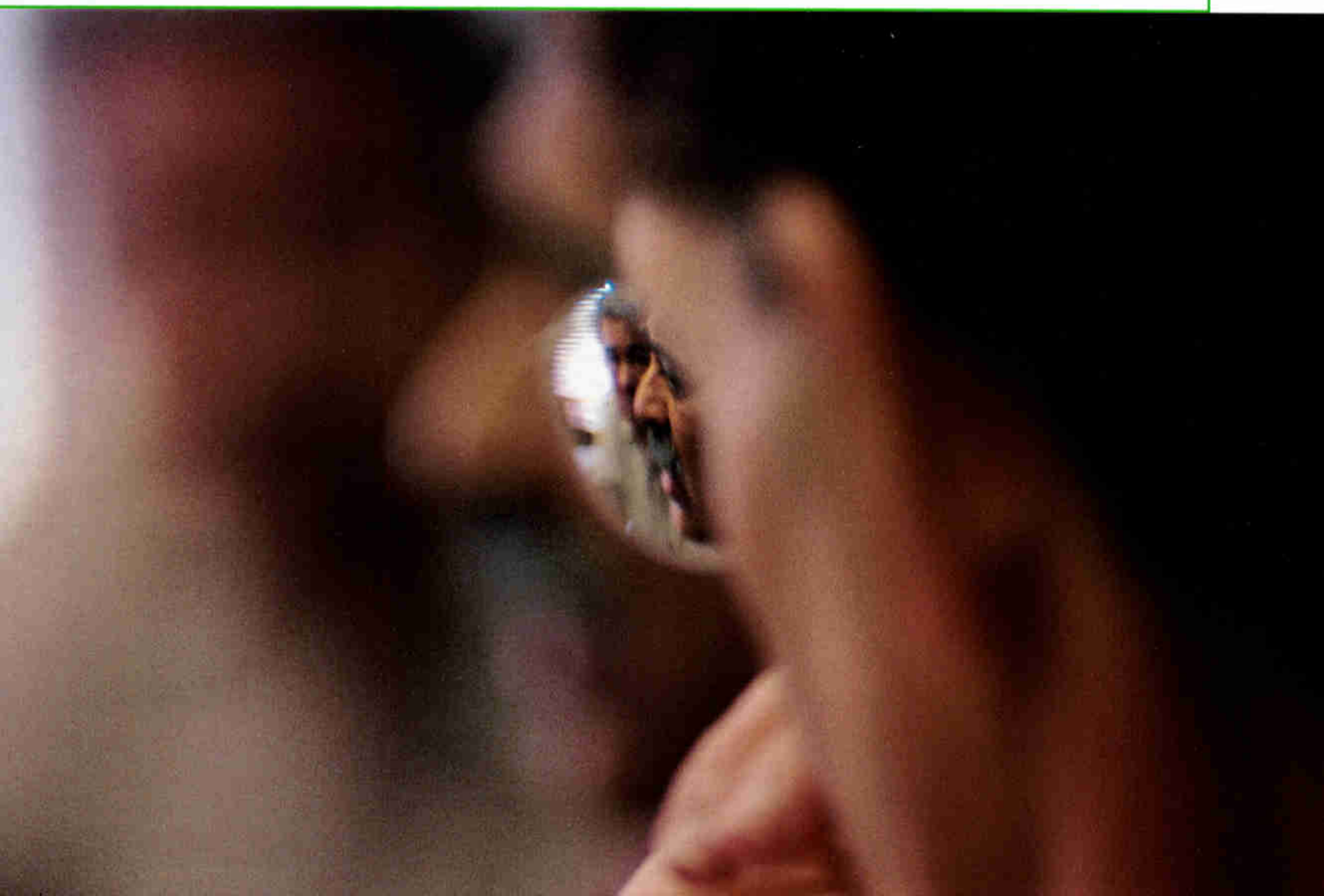
the East, if you fail, you're a pariah. Not here."

Melcher's company, called There, involves the creation of an elaborate, sophisticated cyberspace playground, and it is, he knows, very high risk.

Lee Hwang left a well-paying job in Atlanta because she wanted a change. She found it at There. Her brother-in-law is the chief technology officer for the company, and she had been hired to keep Cokes in the refrigerator and answer the phone. "I sold off everything I had and came here to work a 12-hour day," she said, as we sat in the kitchen of the warehouse building that houses There in Menlo Park. "I have friends in Atlanta who think I'm crazy. Even if it tanks, it's an adventure. The coolness factor is high. I don't want to reach the end of my life and have any regrets."

Hwang, at least, could live with her sister and brother-in-law. At the building where There is taking shape, a handful of employees were living in their offices and sleeping on futons. "It's weird rolling out of bed and going to work," confessed Matt Murakami, a 24-year-old artist. *(Continued on page 74)*

software firm, Bonde hopes to raise four million dollars from investors. An eye for winners distinguishes managing partners Kevin Fong and Yogen Dalal (left to right, seen through glasses). Their venture capital firm, Mayfield, has helped launch such giants as Compaq and 3Com.





Mountain View High School algebra teacher Marcia Babiak (left) won't move back to her native Illinois. "I'd make more in the district I grew up in, but it snows and it's 20 below zero." Babiak loves her active lifestyle, which she carries into the classroom, acting out the slope of a graph.

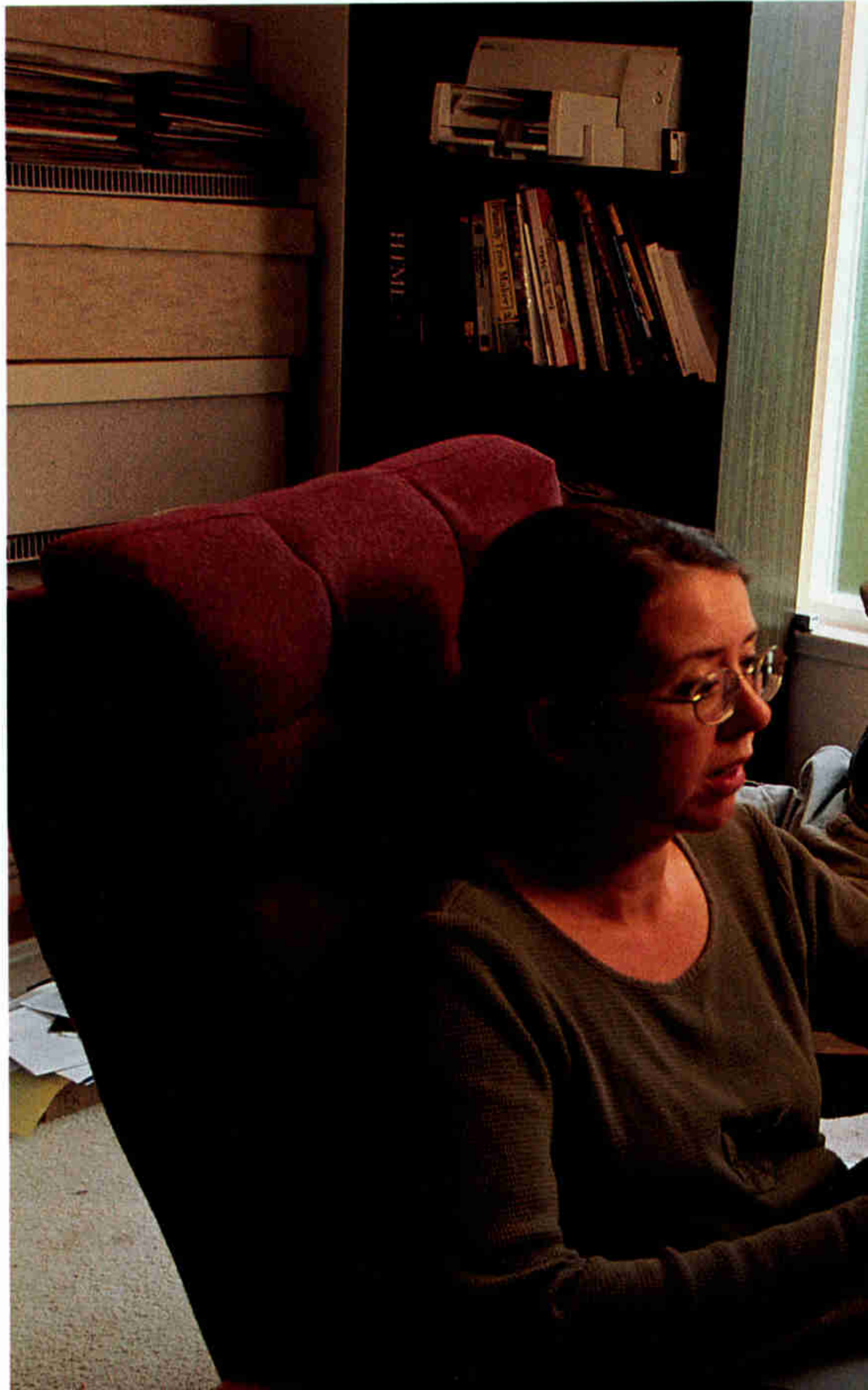
With toys and computers battling for space in Dave Shelley and Laura Bowen's San Jose home, the line between producing computer games and raising two sons fades quickly. As Shelley lifts two-year-old Niall, the workstation becomes

CHOOSE

committing to a place

a playstation. Shelley finds comfort in Niall's visits: "It's refreshing to blow bubbles with him." Trendiness is not a distraction for Niall's mother. "We're out of the loop for Internet launch parties, BMWs, and designer clothes," says Bowen. "We think of the area as home rather than a hot spot."

Though her classroom is twice the size of her apartment,



**“DRIVING FROM THE AIRPORT, I SAW
CANDLESTICK PARK, THE PACIFIC OCEAN,
AND FELL IN LOVE WITH THE PLACE.
THREE WEEKS LATER I MOVED HERE.”**

MARCIA BABIAK, HIGH SCHOOL TEACHER





STRUGGLE

A decent technician's wage in the computer industry can't keep John Singh and his young family out of a homeless shelter in San Jose. Between them Singh and his wife, a registered nurse, earn \$105,000 a year. Yet exorbitant



rents and a dispute with a landlord left the Singhs and their three children little choice but to move into a room at the Boccardo Reception Center, a former General Electric office complex that serves as San Jose's largest shelter. More than 40 percent of the shelter's residents have jobs.

(Continued from page 69) Murakami had moved from Orange County and, after a month's stay with relatives, decided to move into his cubicle. He was working late nights, anyway, and couldn't see paying \$1,500 a month in rent. "I've put my life on hold till the IPO [initial public offering]," he said.

Some may think that this is a character flaw, but I prefer to be 'always connected,' she is quoted as saying.

Wired, perhaps. But connected?

"I must leave," a woman at Stanford said, drawing the interview to a close. "I have an appointment with my psychiatrist." She moved



SEEK

Always thinking, Tom Proulx, the creator of Quicken financial software, prepares a brainteasing Easter egg hunt for friends at his Atherton estate. Teams must find ten eggs, each bearing a clue to the next egg's location. One task: building

"If it weren't for the skylight in the building, I wouldn't know if it was night or day."

One morning the newspaper carries a story about a partner at a venture capital firm. She has two cell phones—a Nokia 6100 and a Nokia 8860—and two handheld computers—a Palm Vx and a Handspring Visor Edge—not to mention a BlackBerry RIM 957 e-mail device. At home the lineup is three computers (one in the kitchen), four printers, and a fax. "The only time when I turn everything off is on a plane.

from the Midwest and is mourning the loss of not just a three-story house with 20 acres but also deep and true friends. "There is no time here for deep connections. There are no deep conversations and relationships," she said. Distress shadowed her face. "I don't have the words to express how I feel. I have to pay someone to talk about these things."

"I have a patient who begins by saying 'Everything is fine, but I feel like a machine,'" said Kenneth Seeman, a psychiatrist in Palo Alto. "You are dealing with professions oriented toward technology. Many here are more

comfortable with machines than people. They hide behind that.”

The genius of Silicon Valley helped wire the world. Its enterprise could get you an airline ticket, a refrigerator, or stock quote at the click of a mouse. But the social fabric seemed to be unraveling. Though the Valley’s per capita income increased 36 percent during the 1990s (the national increase was 17 percent), by the year 2000 a household at the bottom 20 percent of the distribution scale had less income than in 1993. The rising tide hadn’t lifted all boats.

“We’re like a specialized athlete. We just do innovation and invention,” Jim Koch explains. Koch is director of the Center for Science, Technology and Society at Santa Clara University. He spoke about his recent report that examined the social capital—the community connectedness—of 40 different communities across the U.S. Although Silicon Valley ranked high in interracial trust and diversity of friendships, it landed near the bottom in civic engagement, charitable giving, volunteering, and civic leadership—and in sense of community as well.

There are reasons for this, Koch explained, and they have to do, in part, with a business ethos that eschews commitment. “The culture says you don’t stay in one place very long. You jump from job to job.

“I think we feel lonelier and more isolated,” he said. “I think life as a free agent is not what it’s cracked up to be.”

which start-ups flared and fizzled. But Silicon Valley prefers to look forward. The Valley is about ideas and invention, but it is also about money—which happens to be one of the things people wish for you on the Chinese New Year.

I had driven to Redwood City, the not-quite-as-chic town north of Atherton, to talk to George J. Leonard, a professor of humanities and Asian studies at San Francisco State University. We sat in his teahouse, a sanctuary really, in back of his modest home while Leonard poured green tea into thimble-like cups. As the fragrance of tea filled the room, we admired the translucent glaze of a celadon bowl and an earthenware pot in the shape of a lotus leaf.

Silicon Valley sits on the edge of the future. Perhaps it even is the future. Yet, so many were being left behind. The contrasts were as unsettling as the earthquake zone that helps define its geography. To keep my balance, I needed an anchor, a steady handhold. Leonard offered one, using as a framework the teachings of Confucius.

“Confucius says, ‘Of course, you want to be rich and famous,’” Leonard said. “‘It’s natural. Wealth and fame are what every man desires.’” But Confucius understood there is a moral decision too, and sooner or later an accounting begins.

“‘The question,’ Confucius said, ‘is what are you willing to trade for it?’” □

MORE ON OUR WEBSITE

Find an update on the key players in our 1982 Silicon Valley article at nationalgeographic.com/ngm/0112.

AOL Keyword: NatGeoMag

a human ladder to pluck an egg from the top of a wall. Winning time was three-plus hours. Fortunately, losing is a temporary state of mind in Silicon Valley. After an auction of company equipment, two employees of a failed Internet cable channel are already talking about new possibilities.

Chinese New Year was approaching, and at the Lion Plaza mall on Tully Road—one of those faux California-mission confections of aqua and terra-cotta concrete—you could find Johnny Au selling plants. “For good fortune,” Au said, explaining the tradition. “Buy these pussy willows for silver,” he pulled a branch from a bucket. “And this tree,” he indicated a 15-year-old bonsai with yellow flowers, “for gold.”

A New Year in all cultures is a chance to look back to the past and ahead to the future. Silicon Valley could look back to a wild ride in





The Future is

IT TOOK 100 YEARS TO CONNECT THE FIRST BILLION PEOPLE BY PHONE

BY THOMAS B. ALLEN

Little orange flags have sprouted along the sidewalks in Bethesda, a Maryland suburb just over the line from Washington, D.C. I have seen enough of these flags to know that they fly for the diggers. Someday soon the diggers and



A SMALL WORLD AFTER ALL?

The future's bright; wish you were here. Fiber-optic and wireless networks are changing the way we live, at least in places like London (left). In rural Yugoslavia (below) a woman borrows a visitor's cell phone to make a call in a town without telephone service.

burgeoning Internet, doubling in size every year, spewing information on a scale unprecedented in history. And it is a world with a "digital divide" that separates the connected people from people so unconnected that hundreds of millions of them have never even made a phone call.

Those orange flags mark the trails of fiber-optic diggers. "Orange means communications—fiber-optic these days," Martin said. This morning the crew was stringing, not digging. Fiber-optic cable would go overhead on utility poles for a stretch and then dive underground, joining my phone company's eight-million-mile nationwide fiber-optic network.

The pencil-thin cable spins off its reel and flows into a black duct stiff enough to provide a pathway, whether the cable goes aerial or into the ground. It contains dozens of glass fibers, each thinner than a human hair. They are called dark fibers until they go to work, transmitting pulses of laser-generated light. Carried within the light are digitized voices, videos, computer signals, or anything else that can be made of bits. Each fiber can itself become a tiny cable capable of hauling even more signals.

The capacity of a fiber is measured in the number of bits sent per second. Megabit (a million bits) defined the capacity of early fiber-optic cables. Next
(Continued on page 82)

Calling

AND ONLY 10 YEARS TO CONNECT THE SECOND BILLION.

their backhoes and their flashing warning lights will arrive to tear up the roads and slow down traffic so they can bury something. But what?

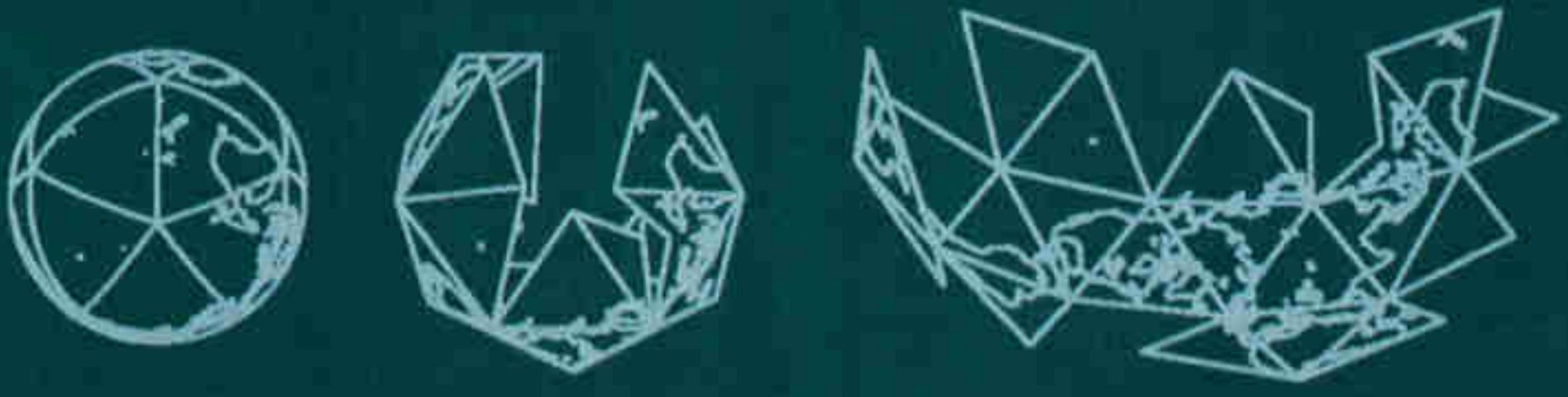
Not far from my home I caught up with Martin J. Droney, who was running a crew of telephone company workers. Martin introduced me to the rewiring of the world. It is a world of cables buried on land and in seabeds, a world of cascading e-mail messages and a



CONNECTING THE PLANET

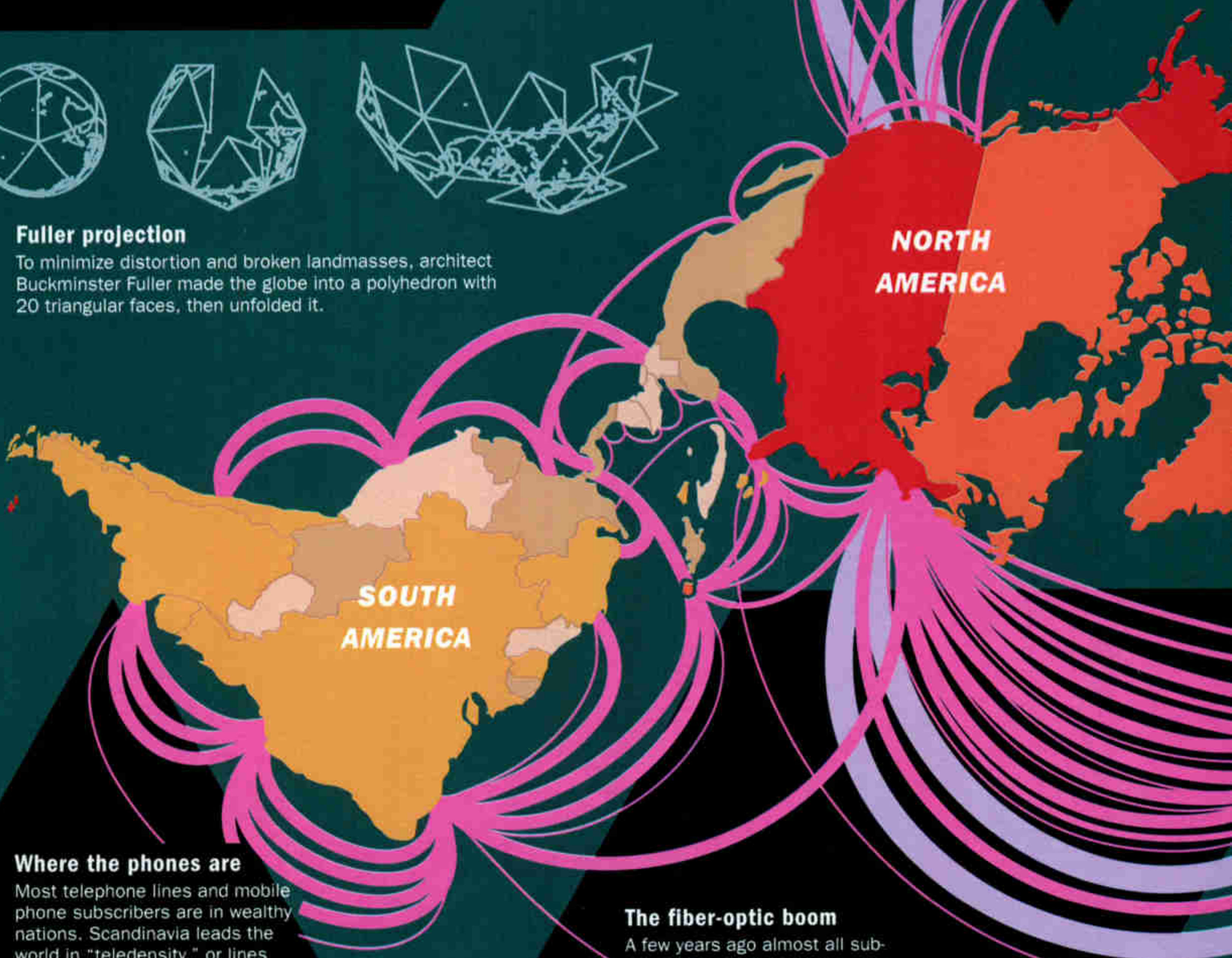
THE WHOLE WIRED WORLD

Cables are back. Copper wires carried most international communications from the 1850s until satellites took over a century later. Now most messages travel as laser beams in fiber-optic cables. Fueled by frenzied Internet investment, millions of miles of fiber have been laid. Most of it connects economic powers, and much of it is unused. "The new bandwidth came like a desert shower," says Tim Stronge of TeleGeography, Inc. "Rich countries got flash flooding; poor countries were untouched."



Fuller projection

To minimize distortion and broken landmasses, architect Buckminster Fuller made the globe into a polyhedron with 20 triangular faces, then unfolded it.



Where the phones are

Most telephone lines and mobile phone subscribers are in wealthy nations. Scandinavia leads the world in "teledensity," or lines per capita. Norway has more lines than Bangladesh, a country with 30 times as many people.

Teledensity

Telephone lines and cellular subscribers per 1,000 people

- More than 1,000
- 500-1,000
- 250-499
- 100-249
- Less than 100

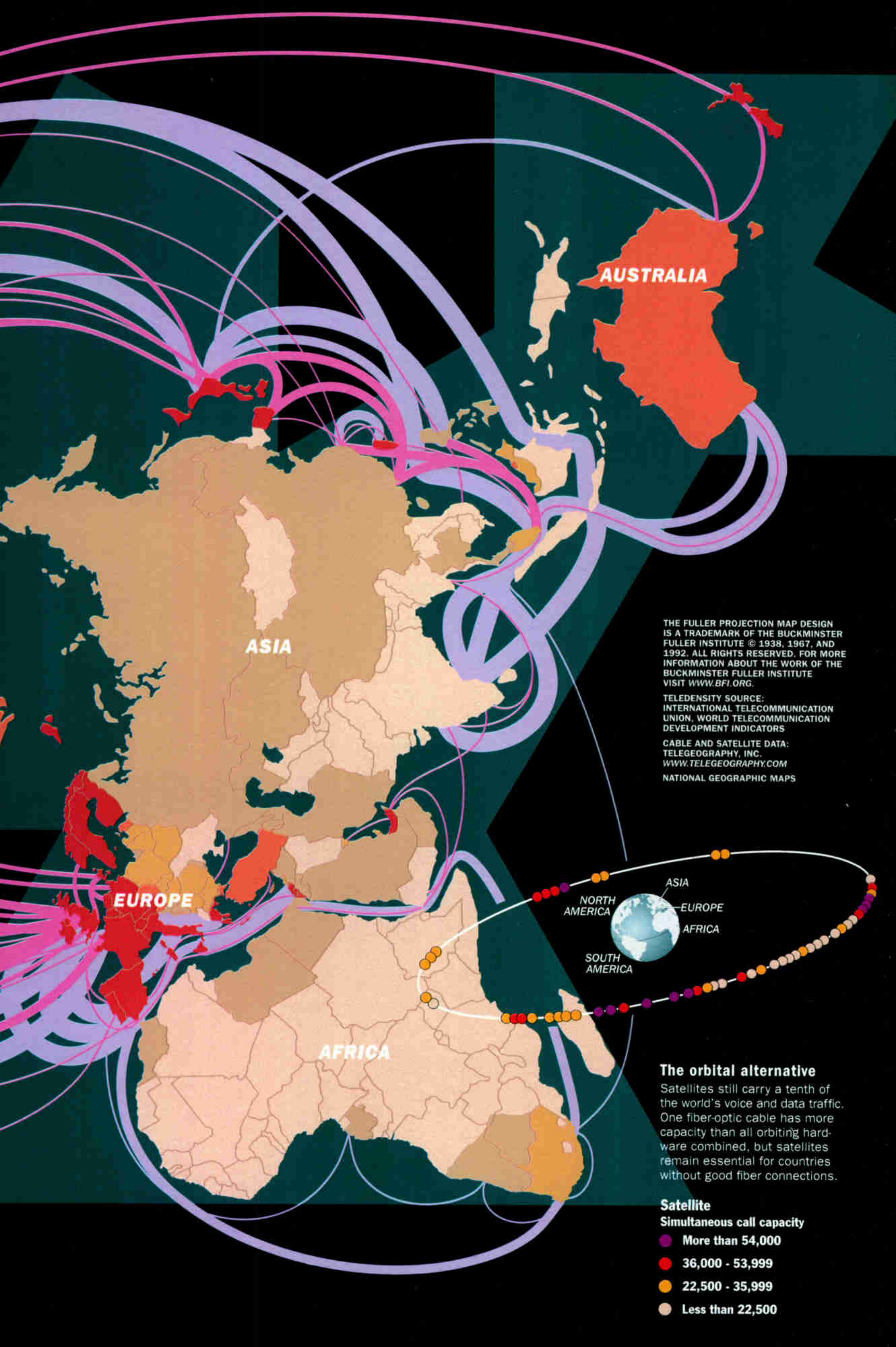
The fiber-optic boom

A few years ago almost all submarine fiber-optic cable connected the U.S. to Europe and Asia. Now the rest of the world is going glass. The capacity of the world's underwater fiber cables has grown 100-fold since 1995.

Fiber-optic submarine cable

Cable in service		Gigabit capacity
Sept. 2001	Planned by Dec. 2003	
		More than 3,000
		1,000-2,999
		100-999
		1-99

TM



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TELEDENSITY SOURCE: INTERNATIONAL TELECOMMUNICATION UNION, WORLD TELECOMMUNICATION DEVELOPMENT INDICATORS

CABLE AND SATELLITE DATA: TELEGEOGRAPHY, INC. WWW.TELEGEOGRAPHY.COM NATIONAL GEOGRAPHIC MAPS



The orbital alternative

Satellites still carry a tenth of the world's voice and data traffic. One fiber-optic cable has more capacity than all orbiting hardware combined, but satellites remain essential for countries without good fiber connections.

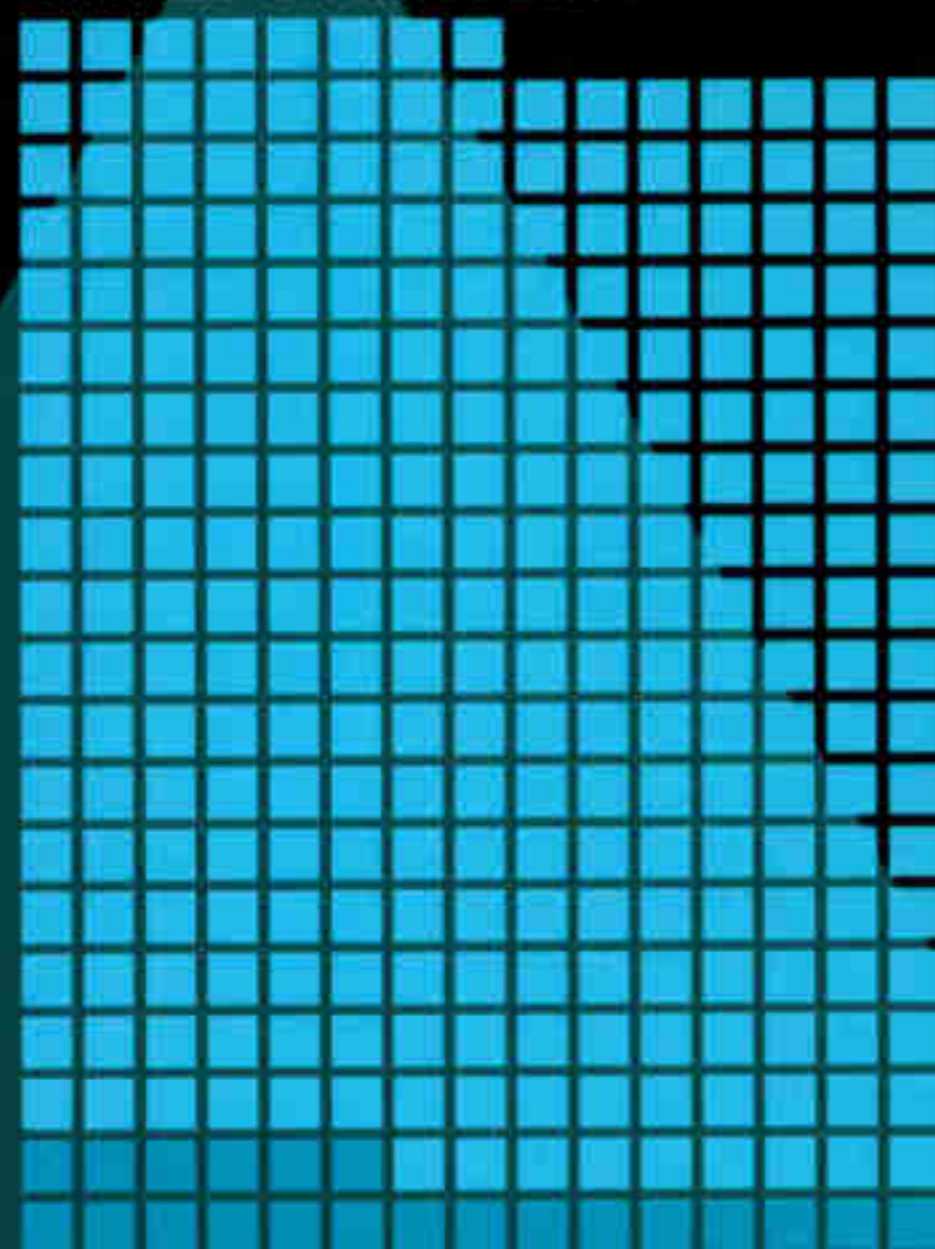
- Satellite**
Simultaneous call capacity
- More than 54,000
 - 36,000 - 53,999
 - 22,500 - 35,999
 - Less than 22,500

THE INTERNET EXPLOSION

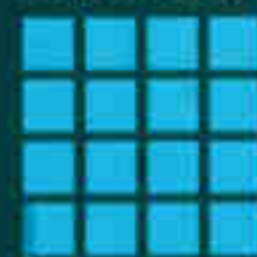
RUSH-HOUR TRAFFIC

Why did the cable cross the sea? The Internet drives demand. International telephone calls continue to increase, but phone use can't keep up with Internet traffic, which doubles every year. The volume of data transmitted on U.S. long-distance lines should exceed voice traffic within a year; world crossover will follow soon. Predictably, most traffic flows between countries with the best technological infrastructures. More than 96 percent of computers connected to the Internet are in the wealthiest nations, home to 15 percent of the world's population.

UNITED STATES 293



URUGUAY 16



0.2



Have tech, will surf

Less than a decade after the Internet's commercial debut, almost half the inhabitants of the developed world have become users. A lack of personal computers and phone lines prevents the rest of the world from keeping pace. In India, a leading software producer, only about 5 in 1,000 people use the Internet.

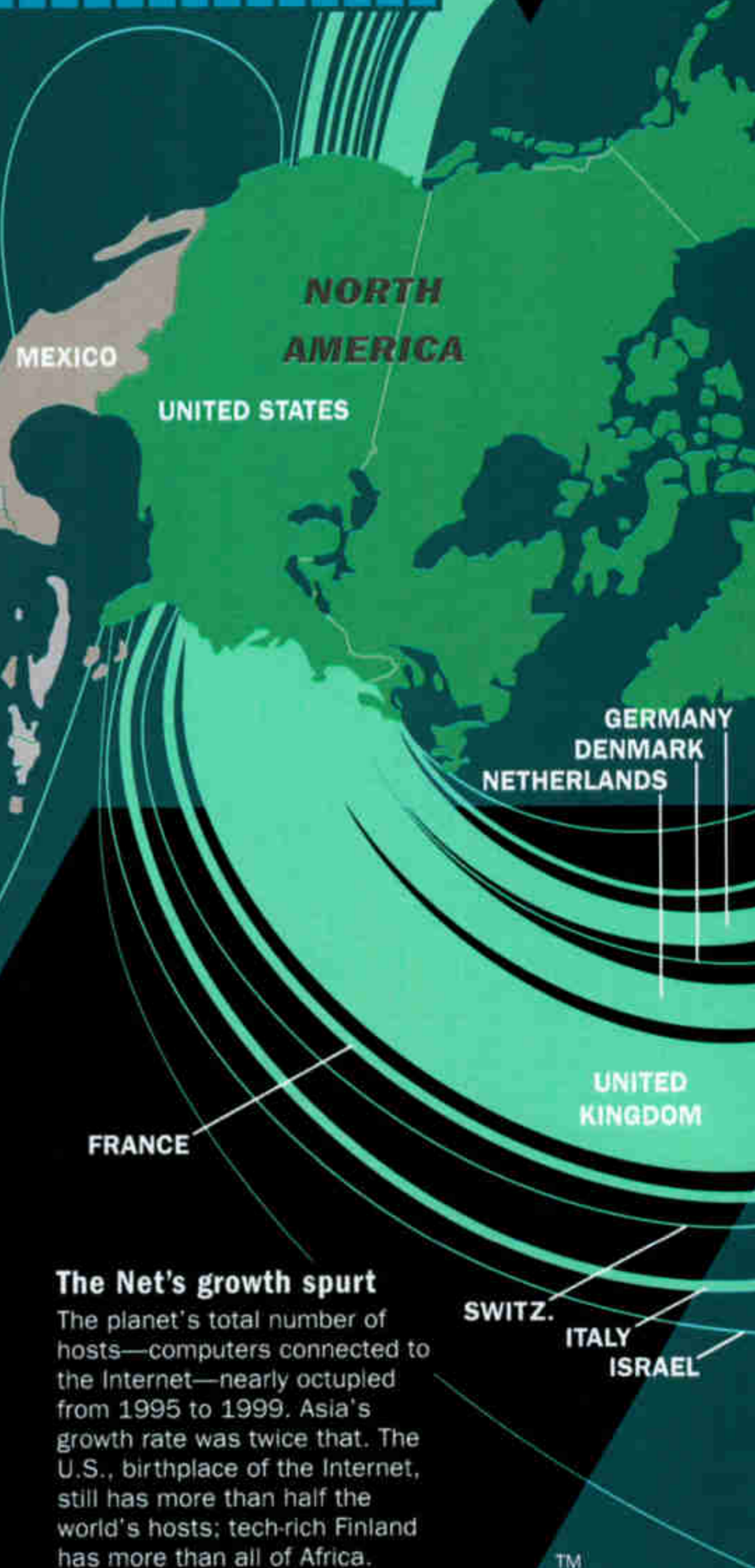
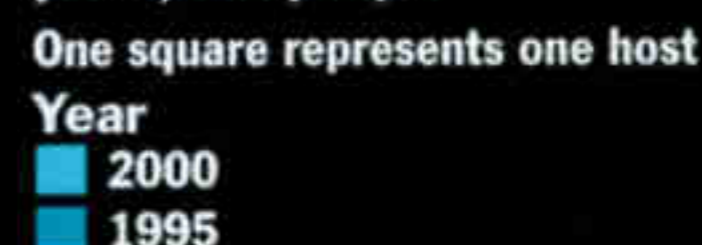
Internet users per 1,000 people



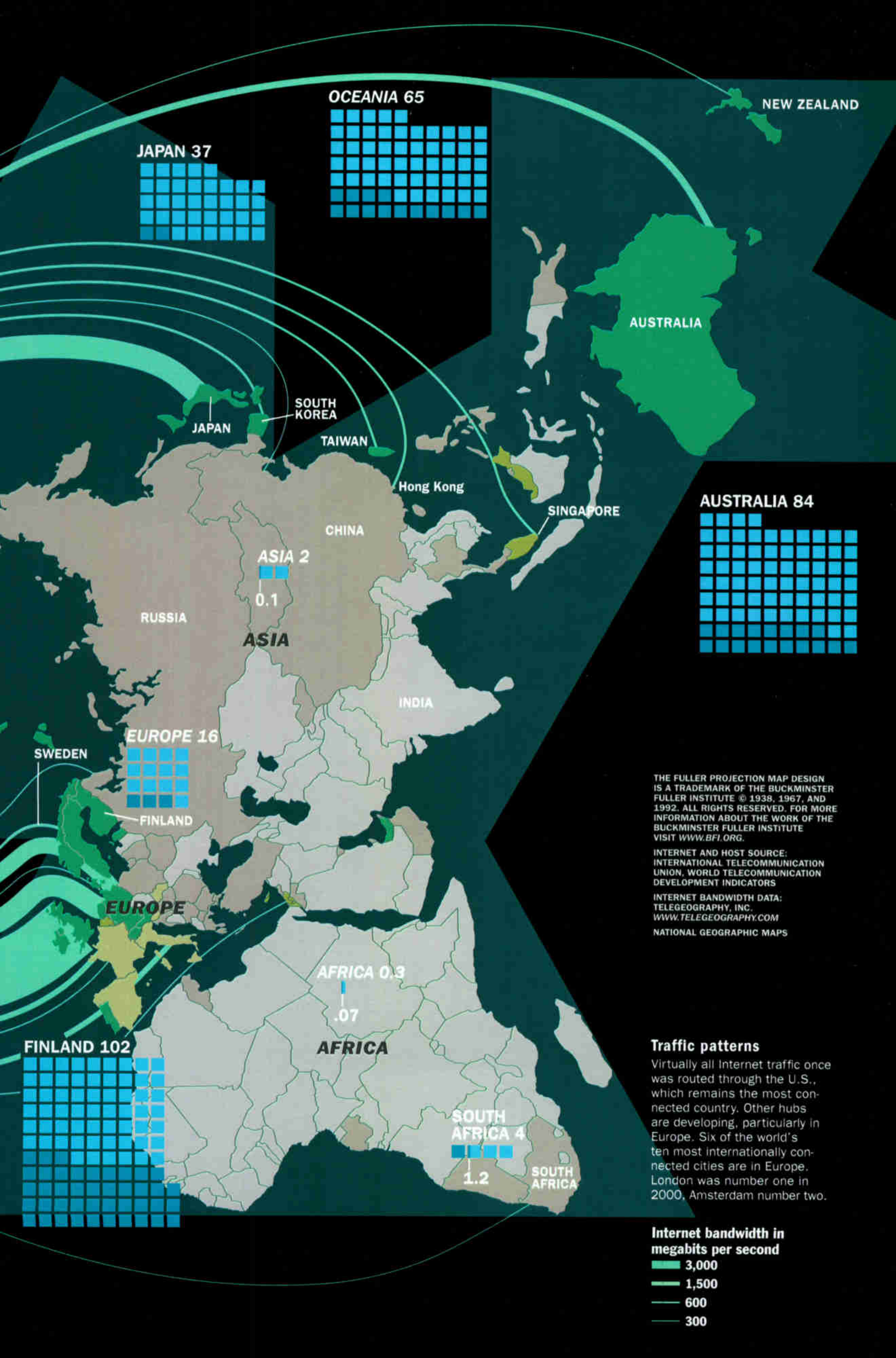
The Net's growth spurt

The planet's total number of hosts—computers connected to the Internet—nearly octupled from 1995 to 1999. Asia's growth rate was twice that. The U.S., birthplace of the Internet, still has more than half the world's hosts; tech-rich Finland has more than all of Africa.

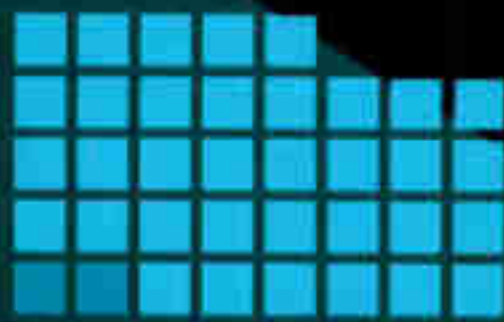
Internet hosts per 1,000 people



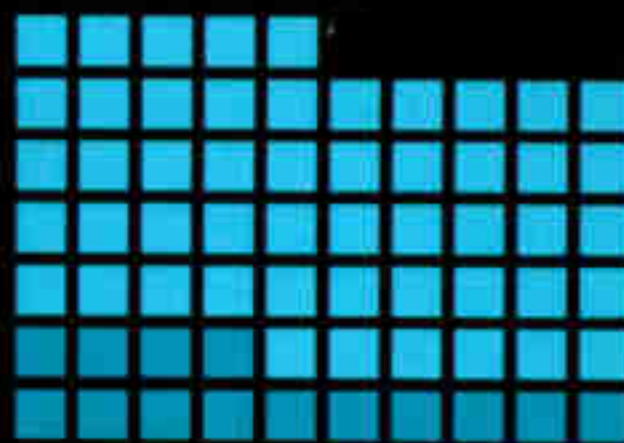
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JAPAN 37



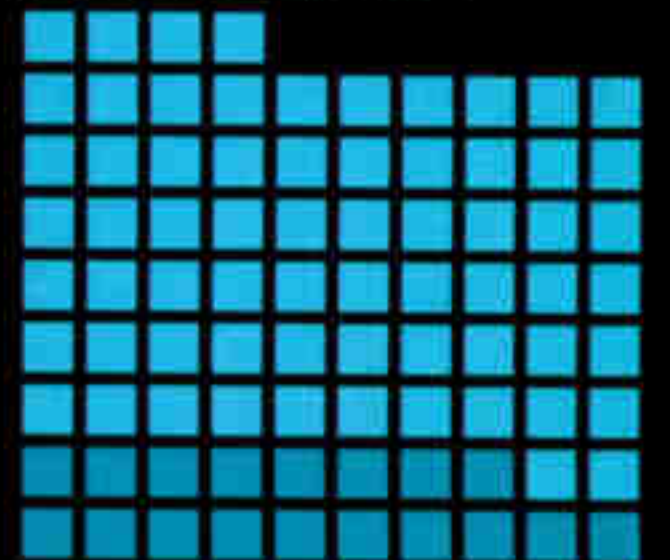
OCEANIA 65



NEW ZEALAND

AUSTRALIA

AUSTRALIA 84



JAPAN

SOUTH KOREA

TAIWAN

Hong Kong

SINGAPORE

CHINA

ASIA 2

0.1

ASIA

RUSSIA

INDIA

EUROPE 16

SWEDEN

FINLAND

EUROPE

AFRICA 0.3

.07

AFRICA

FINLAND 102



SOUTH AFRICA 4

1.2

SOUTH AFRICA

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INTERNET AND HOST SOURCE: INTERNATIONAL TELECOMMUNICATION UNION, WORLD TELECOMMUNICATION DEVELOPMENT INDICATORS

INTERNET BANDWIDTH DATA: TELEGEOGRAPHY, INC. WWW.TELEGEOGRAPHY.COM NATIONAL GEOGRAPHIC MAPS

Traffic patterns

Virtually all Internet traffic once was routed through the U.S., which remains the most connected country. Other hubs are developing, particularly in Europe. Six of the world's ten most internationally connected cities are in Europe. London was number one in 2000, Amsterdam number two.

Internet bandwidth in megabits per second

- 3,000
- 1,500
- 600
- 300

came gigabit (a billion), and now comes terabit (a trillion). The latest transatlantic cable is rated at 2.4 terabits. In one second, that cable can transmit a hundred hours of digital video or 30 million phone calls across the Atlantic.

An estimated 35 million miles of fiber lace America. But some 90 percent of the land cables are dark. Telecommunications executives, swept along by the booming Internet, vastly overestimated demand.

Martin sketched a diagram to show how my home phone's copper wire has to go through various telephone-system way stations before it reaches the kind of fiber-optic cable his crew

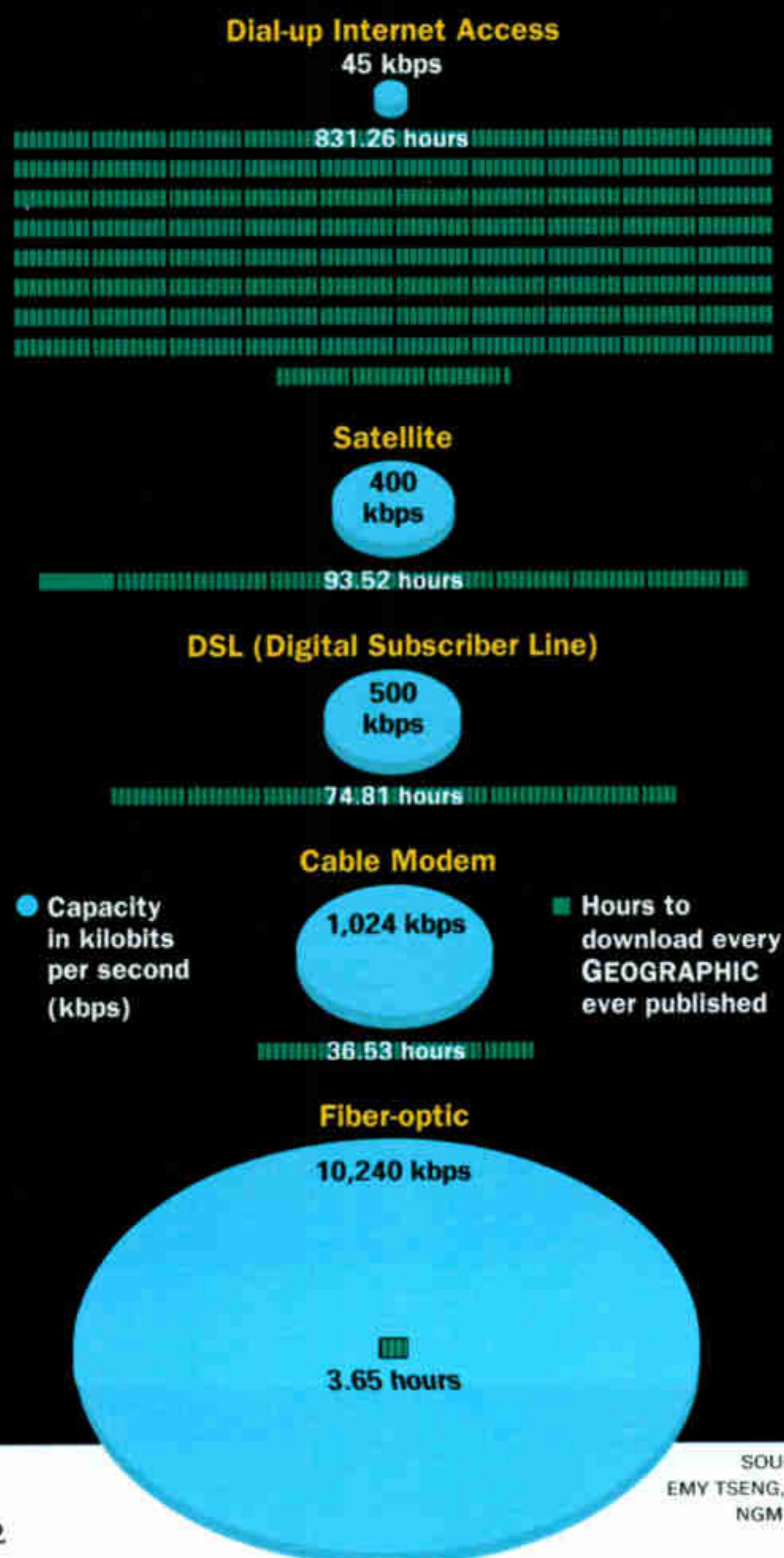
was installing. If I make a call to, say, London, my connection might be through the Fiber-optic Link Around the Globe (FLAG), a 51,600-mile network that stretches from its London base to the rest of the world.

Until a few years ago my call probably would have gone to London via satellite. Now satellites orbit an Earth whose nations are increasingly tied together by submarine cables. To trace the likely path of my call, I flew to London and via a train and taxi reached a little Cornwall town named Porthcurno, at Land's End, the westernmost tip of England. Cables have been rising from the sea here since the Victorian age, when words of commerce, diplomacy, and war poured in and out of Porthcurno, the cable capital of the British Empire. Today the new 2.4-terabit Atlantic cable passes invisibly from a tranquil bay to a trench beneath a patched, gorse-lined Porthcurno lane.

Entrenched cables carry the transatlantic traffic along roads and highways to London, where it enters what is commonly called a "telehouse."

FAST, FASTER

Internet data files around the world faster than ever, but how quickly it reaches your home computer depends on the bandwidth—the amount of digital data transmitted per second—of your "last mile" connection. Various factors slow speeds; this chart shows capacities under typical conditions. Because of cost and availability most people still get their data over preexisting phone lines.



SOURCE: EMY TSENG, MIT NGM ART

TODAY FIBER-OPTIC CABLE CAN

Links between cable and consumer, telehouses have popped up in cities throughout the world, coddling cables with air-conditioning, protecting them with high-tech security, and connecting them to local networks. London's Telehouse Docklands is a gleaming six-story building on Coriander Avenue. Nearby streets are named Oregano, Rosemary, and Nutmeg, recalling the days when these were the spice docks.

To get in, I had to consent to a physical search and pass through tight security. Escorted by a young systems architect named Vincent Alder, I entered a building that had few people, much space, some metal boxes sprouting colored wires, and rows of empty racks waiting for more "magic boxes," as Vincent calls them—the servers, routers, and other equipment needed for the Internet. "It's like watching a supernova," Vincent said, his hands sweeping through the emptiness. "No one knows how it's going to end."

The first wiring of the world began in 1850, only six years after Samuel Morse demonstrated the reality of telegraphy. British engineers made a copper-wire cable, insulated it with gutta-percha (a rubberlike Malayan tree sap), and laid it across the English Channel.

Soon came a cable across the Atlantic. On

August 16, 1858, Queen Victoria sent a hundred-word message to President James Buchanan. Some of the royal words reached Washington that day; the rest came through on the 17th. Agonizingly slow and chronically unreliable, the cable went dead after three weeks.

The problem was the behavior of electricity in cables. Convinced that they had found the solution, engineers tried again, this time with the world's largest ship, the *Great Eastern*. In July 1865 she set out from England with a crew of 500, a dozen oxen for hauling, a cow for fresh milk, a herd of pigs for bacon—and a thickly insulated 2,800-mile cable that weighed 5,000 tons. They had almost finished laying it when the cable snapped. The next year they succeeded.

Cable laying continued through the 19th century and into the 20th. Words were humming along at more than 200 a minute, compared with 12 a minute in 1866. But cable met competition when wireless telegraphs, in 1901, and commercial telephone calls, in 1927, began crackling across the Atlantic on radio waves. Not until

by that nation's investment in communications.

"Distance learning," through satellite-beamed videoconferences, is also bridging the digital divide. The African Virtual University, for example, has a faculty of North American and European professors whose lectures are televised and sent to students in 16 African countries. The virtual university also offers computer courses to African teachers lucky enough to have computers in their classrooms.

I did a little distance learning myself in a World Bank Institute videoconference classroom. Through its satellite network the institute connects learning centers in some 30 countries. Discussions range from health care to preventing corruption.

I looked at myself projected on a large screen, along with squares occupied by images of African entrepreneurs who run computer centers in Senegal, Côte d'Ivoire, and Ghana. The centers serve as paths to the connected world's information highway. People get their first look at the Internet, send their first e-mails

TRANSMIT 30 MILLION PHONE CALLS ACROSS THE ATLANTIC A SECOND.

1956 did a telephone cable span the Atlantic. Then in 1965 the first Early Bird Satellite went into orbit, and again cable became a has-been.

But by the mid-1990s, thanks to fiber optics, cable was making a comeback, carrying most telephone calls between the United States and Europe, Japan, and Australia. Pulsing with Internet data packets, cables connect more than 80 nations, carrying far more telephone calls than satellites or mobile phones. But those mobile phones and satellites are bridging the digital divide, using wireless networks as a way to connect the unconnected.

Maps of the rewired world vividly show the divide. One wide swath, from North America to Europe, is dense with communications, while vast areas, such as the African and South American continents, are blank. When the connected world reaches those blank spots, the people in them begin to prosper, says Vinod Thomas, vice president of the World Bank Institute, created in 1999 to serve as a knowledge bank for developing countries. He handed me a chart that compared South Korea and Ghana, which both had about the same level of poverty in 1962. Then, while the average income level stagnated in Ghana, South Korea's income started to soar, aided

(Gregory looks for lost relatives), speak up in chat rooms ("... I didn't come here to bandy words with you"), and learn how to sign up for distance-learning university courses.

Many countries, such as China and Brazil, avoided the lengthy and expensive process of stringing more nationwide telephone lines by leapfrogging over copper wire and setting up cellular phone systems. Shanghai, for instance, with a population of 17 million, has more than 3 million mobile phone users.

It took a hundred years to connect a billion people by wire. It has taken only ten years to connect the next billion people.

The Internet gave cable a new set of customers. A round-trip satellite signal takes a quarter of a second, an endurable delay during a phone conversation. But for the connected on the Internet, delay is intolerable and time is measured in nanoseconds. Internet facts and foibles move along fiber-optic cables at nearly the speed of light. The Internet seems to be neither here nor there. In the rewired world, as hackers say, the world is one big wire, and distance is dead. □

MORE ON OUR WEBSITE

Connect to our forum on connecting the world at nationalgeographic.com/ngm/0112. AOL Keyword: NatGeoMag

NATIONAL
GEOGRAPHIC
RESEARCH AND
EXPLORATION



GRANTEE

Paul Sereno
Paleontologist
Niger, Africa

Quote: "To visualize what can't yet be seen—that's the key to big fossil discoveries."



Roughly 40 feet from head
to tail, an ancient reptile
unearthed from the
sands of the Sahara has
earned the nickname

SUPER CROC



Down and dirty for science, National Geographic Explorer-in-Residence Paul Sereno (fourth from front) and his team flesh out *Sarcosuchus imperator*. This huge crocodilian, which ruled Africa's middle Cretaceous rivers some 110 million years ago, was among the world's largest crocs.

By Paul Sereno
Photographs by Mike Hettwer

We had never seen anything like it. With brushes and awls we teased away the rock encasing its fossilized jaws. They were huge, each about as long as an adult human. Yet the animal that had once wielded these jaws was not a dinosaur. It was a colossal crocodilian.

We had come to hunt dinosaur bones in the Sahara's legendary fossil graveyard, a remote windswept stretch of rock and dunes called Gadoufaoua. In Tamashek, the language of the desert's Tuareg people, Gadoufaoua means "the place where camels fear to tread." For fossil hunters it means paradise—the richest dinosaur beds on the African continent. Now less than an hour into our four-month expedition we were face-to-face with an ancient croc that could have



ART BY RAUL MARTIN

Found intact on the desert floor, this tiny, broad-snouted skull belongs to a new species of dwarf croc. At least five species of crocs inhabited this part of Africa in the middle Cretaceous, when broad rivers coursed over lush plains (below). *Sarcosuchus* was the monster among them, devouring fish and challenging even such rivals as the spinosaur *Suchomimus tenerensis*, which speared fish with its sickle-shaped claws.

posed a serious threat to any dinosaur within reach.

This croc wasn't new to science. Some of its conical teeth, vertebrae, and foot-long armor plates, or scutes, were first discovered by French paleontologist Albert-Félix de Lapparent. In 1966 his niece France de Broin and fellow paleontologist

Philippe Taquet named the creature *Sarcosuchus imperator*, the "flesh crocodile emperor."

We called it SuperCroc. And we were hoping to answer some lingering questions about this little-described giant.

Expedition 2000, funded in part by the Society's Expeditions Council and its Committee



for Research and Exploration, was my fourth to the Sahara, and it was no holiday in the sand. We had to transport trucks, tools, tents, five tons of plaster, 600 pounds of pasta, 4,000 gallons of water, and four months' worth of other supplies into the heart of the world's largest desert. Truck-engulfing sand, a trucker strike, and gas shortages cost precious time. But when, on August 30, we finally reached the first of our four camp locations, we struck

it fossil rich right from the start.

"The backbone!" shouted David Blackburn, a student from the University of Chicago. Trenching around a large *Sarcosuchus* skull, he discovered a series of vertebrae snaking into sediments laid down by a river some 110 million years ago. Undeterred by the blistering heat, he and other members of



THE PROJECT

YEAR: 2000

PLACE: Gadoufaoua, Niger

EXPEDITION MEMBERS: 17

FOSSIL IN FOCUS:

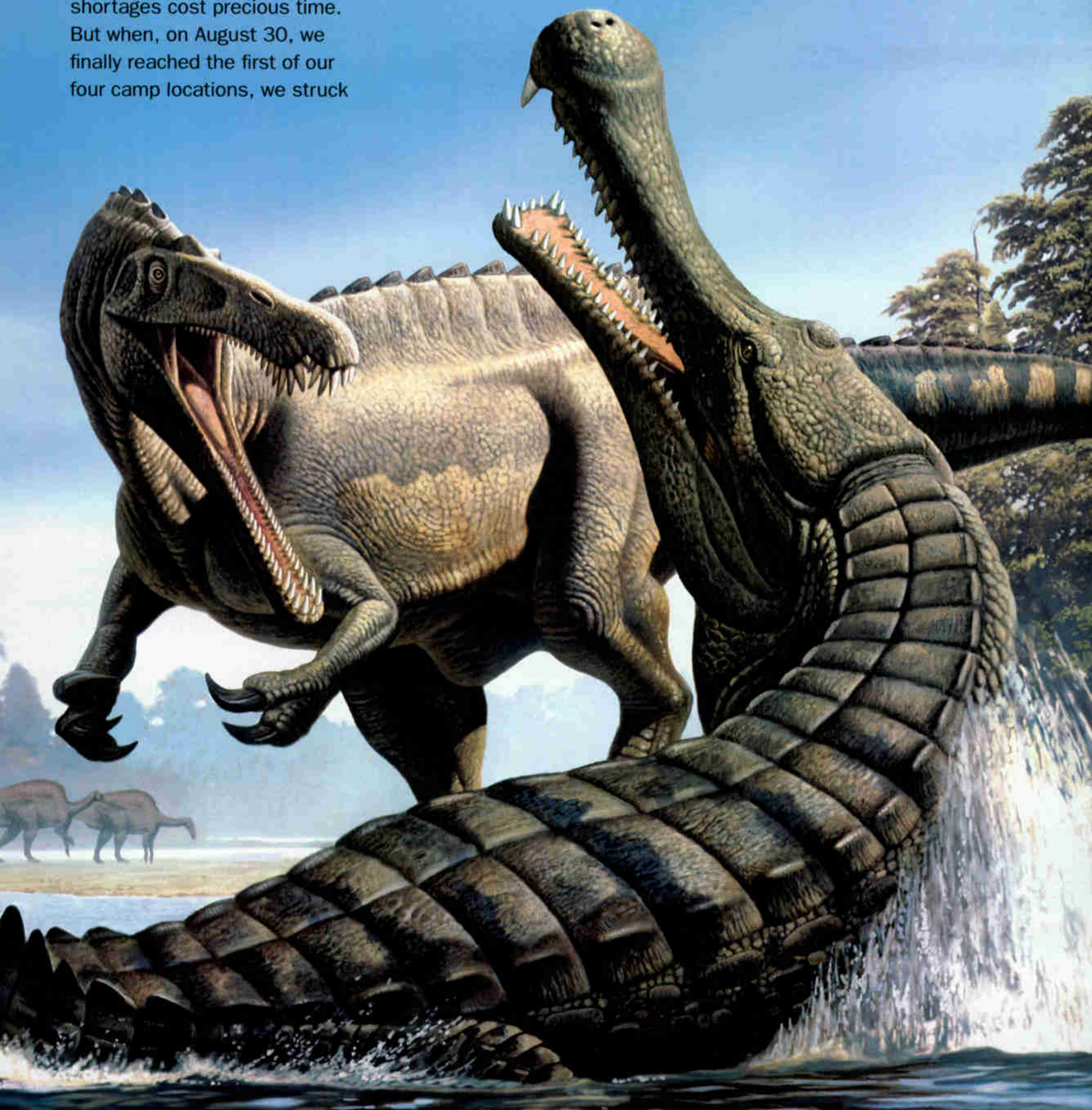
Sarcosuchus imperator

AGE: middle Cretaceous, some 110 million years ago

ESTIMATED ADULT LENGTH:

40 feet

ESTIMATED WEIGHT: ten tons





my 16-person crew were closing in on beautifully preserved pieces of SuperCroc's skeleton.

"Gorgeous armor," mused paleontologist Hans Larsson, examining a stack of foot-long bony scutes that looked like roofing tiles. These would have provided an impermeable shield over SuperCroc's neck, back, and tail. Throughout their evolution all crocs have sported this body armor. It's SuperCroc's skull that's unparalleled.

More than a hundred teeth jut from narrow jaws that must have been adept at snagging fish. And unlike any other croc, living or extinct, SuperCroc's skull gets wider toward the front

Encircled by dunes, a spartan camp at Gadoufaoua was home base for the first leg of a grueling four-month quest for bones. At a nearby outcrop, in temperatures topping 125°F, team members carved out nose-to-nose *Sarcosuchus* skulls (below left). Fossils—20 tons in all—were sealed in protective plaster and laid in camp to await shipment to the U.S. At rest in shifting sands, a set of jaws was left in situ (right) as a sight for intrepid tourists.



end, which is armed with a deadly row of enlarged incisors. These robust bone-crushers suggest that *Sarcosuchus* could eat far meatier prey than fish.

The swollen end of the snout houses an enormous cavity under the nostrils, meaning this croc may have had an enhanced sense of smell and a most unusual call. Its eye sockets project upward—like those of the living gharial in India—for scanning the river's edge while submerged. SuperCroc's skull, then, is like a cross between the elongate skull of a fish-eating gharial and the robust skull of a bloodthirsty Nile crocodile.

With the discovery on this

expedition of several skulls, vertebrae, scutes, limb bones, and other assorted bits, we have amassed about 50 percent of SuperCroc's skeleton, enough to commission a life-size model. Our most complete skull is just shy of six feet. After measuring the bones and comparing them with those of modern crocs, we estimate that a mature adult *Sarcosuchus* grew to about 40 feet long. Its weight? As much as ten tons. Among the very largest crocs that ever lived, *Sarcosuchus* sprouted from a side branch of the crocodylian family tree separate from that leading to modern crocodiles.

Dwarf crocs we discovered

living alongside *Sarcosuchus* represent other lineages that have come and gone. Extinction has trimmed the largest and smallest of the croc family. Yet unlike dinosaurs, crocs today are much as they were more than a hundred million years ago—masters at ambushing prey and one of Earth's most persistent survivors. □

MORE INFORMATION

ON OUR WEBSITE Post questions for Paul Sereno and find his weekly replies at nationalgeographic.com/ngm/0112.

AOL Keyword: NatGeoMag

NATIONAL GEOGRAPHIC CHANNEL See *SuperCroc* on Sunday, December 9, at 8 p.m. ET/PT.



ABRAHAM JOURNEY OF FAITH

Imagine a world saturated with ignorance and hatred, a lonely, brutish place without any hope of redemption. Now, picture a man—Abram, the Bible calls him—who hears a command from God: Leave behind the life you know, and I will one day bless the entire world through you. How this will happen, and why, is a mystery to this man, but he sets out. In time God gives him a new name: Abraham. In time he will become the patriarch of three monotheistic faiths—Judaism, Christianity, and Islam. And history will be forever transformed by his story.





Driven to make the hajj—the annual Islamic pilgrimage of prayer and piety—Muslims in Mecca circle the Kaaba, the shrine God commanded Abraham (or Ibrahim, as Muslims call him) and his son Ishmael to build. More than a billion people—roughly one-sixth of humanity—are Muslims.



Abraham's submission to God is the foundation of their faith, and their holy book is the Koran. Revealed to the Prophet Muhammad in the seventh century, this scripture, Muslims believe, is the divine remedy for distortions that arose in the wake of Islam's earlier prophets—Moses and Jesus.



R

ekindling the flame of faith, Greek Orthodox priests bear witness to the Passion of the crucified Christ during a Good Friday procession in Jerusalem. Christians trace their spiritual lineage from Jesus to Abraham, whose obedience, service, and sacrifice prefigured the coming of the Messiah.



“Abraham embodies mankind’s need and desire to have a relationship with God, but because of original sin we cannot enter God’s kingdom on our own,” says Father Frank Marangos, a Greek Orthodox priest. “Jesus saves from sin not only those who came after him, but all those who came before him—including Abraham.”

WAS THERE EVER, thousands of years ago, a personage named Abraham whom more than three billion people—more than half of humanity—venerate as the father, patriarch, and spiritual ancestor of their faiths? Two billion of them are Christians, 1.2 billion are Muslims, and close to 15 million are Jews. And had Abraham verily spoken with God and celebrated with him covenants that became the foundations of these religions?

The outlines of Abraham's life appear first and most fully in Genesis, the first book of the holy scriptures of Judaism and the Christian Bible's Old Testament.

Abraham also makes frequent appearances in other Jewish and Christian writings, including the Talmud and the New Testament, and he is mentioned time and again in the Koran, the holy book of Islam.

Christianity accepted Abraham as its patriarch almost at its own birth. Paul the Apostle wrote in the New Testament's Epistle to the Romans of *that faith of our father Abraham*. And in the Magnificat in Luke, the Virgin Mary says the Lord helped *his servant Israel in remembrance of mercy; as he spake to our fathers, to Abraham and to his seed for ever*. The Prophet Muhammad, who taught the principles of Islam in the seventh century, similarly honored Abraham, whom the Koran recognizes as one of Islam's prophets: *We believe in God, and the revelation given to us, and to Abraham, Isma'il, Isaac, Jacob*. The Koran elevates Abraham's story to religious practice. Muslims are commanded to prefer the religion of Abraham the Hanif (monotheist), and the Koran says God took

Abraham as Khalil, his "friend."

Yet when I asked scholars the question, "Was there ever a man called Abraham?" as often as not they were respectful (we can't disprove it) but convinced of the futility of trying to find a flesh-and-blood individual. "Abraham is beyond recovery," said Israel Finkelstein, a biblical archaeologist at Tel Aviv University. Without any proof of the patriarch's existence, the search for a historical Abraham is even more difficult than the search for a historical Jesus.

The important thing, we are told, is to assess the meaning and legacy of the ideas Abraham came to embody. He is most famously thought of as the founder of monotheism, although Genesis never credits him with this. The stories do, however, describe his hospitality and peaceableness and, most important, his faith and obedience to God.

Whatever scholars may say about the history of Abraham, Genesis provides an irresistible narrative. So I set out during the year 2000, following

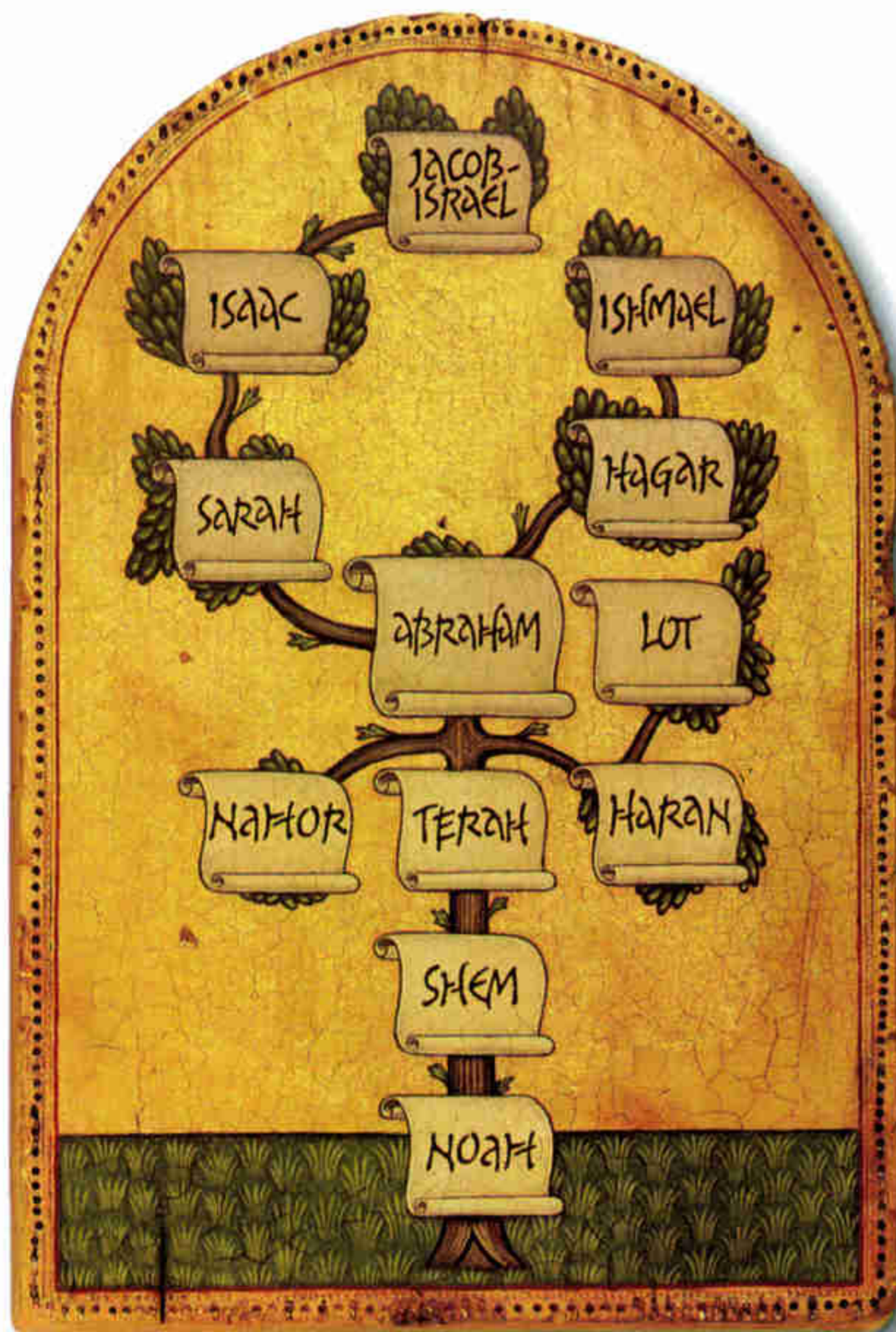


Staking its claim to Jerusalem, an increasingly assertive Palestinian nationalism is fueled in part by a Muslim embrace of the city as the third holiest in Islam. Many Israelis, though, insist their ancient ties to Jerusalem—the locus of Jewish history—trump Palestinian ones. The conflicting claims reach a peak at the city’s spiritual ground zero—what Jews call the Temple Mount and Muslims call the Noble Sanctuary. One proposed resolution, endorsed in 1994 by the late King Hussein of Jordan, was to declare the site to be under the sovereignty of God. “In terms of normal international law, the proposal may seem outlandish,” observes Israeli writer Gershom Gorenberg, “but this particular piece of land is not normal.”

him through Genesis, keeping other scriptural writings and modern scholarship within reach. As Genesis tells it, Abraham was born in Ur of the Chaldees, journeyed to Haran, thence to Canaan and west to Egypt. He returned to Canaan, to Hebron, where he died and was buried in a cave next to his wife Sarah.

When might these wanderings have taken place? Islamic scholarship does not delve into Abraham’s origins,

and in the other two religions there is no firm consensus. Working with the lineages recorded in the Bible, some scholars place Abraham around 2100 B.C. A number of historians who have married biblical history with archaeology converge on the period from 2000 to 1500 B.C.; others argue that the most you can say is that an Abraham figure could have preceded the Israelite monarchy, which began about 1000 B.C.



ART BY MARC BURCKHARDT; CALLIGRAPHY BY JULIAN WATERS

TERAH BEGOT ABRAM, NAHOR, AND HARAN, AND HARAN BEGOT LOT. AND HARAN DIED IN THE LIFETIME OF TERAH HIS FATHER IN THE LAND OF HIS BIRTH, UR OF THE CHALDEES.

(Genesis 11:27-28)

For all his mystery, Abraham remains intensely alive today. In fact, we may even be witnessing a renaissance of his memory. Pope John Paul II—Abraham’s ardent champion—earnestly hoped to make a pilgrimage early in the millennial year in honor of the patriarch, because Jews, Christians, and Muslims all regard themselves as Abraham’s spiritual offspring. In 1994 the pope told me that going to Ur was his dream. “No visit to the lands of the Bible is possible without a start in Ur, where it all began,” he said. But at the last moment, in late 1999, Saddam Hussein, the Iraqi dictator, canceled the invitation.

The pontiff announced that instead he would hold in the Vatican “a spiritual commemoration of some of the

key events of Abraham’s experience.” On February 23, 2000, Rome witnessed a huge Vatican auditorium being turned over to Abraham. When the pope lit branches on an altar recalling

the site of Abraham’s impending sacrifice of his son, smoke and incense filled the auditorium. For a moment 6,000 of us relived the story.

Why is Abraham so vividly alive today? Faith—Judaic, Christian, and Islamic—and his majestic yet elusive presence provide one answer. But the most eloquent explanation I’ve heard originated with Rabbi Menahem Froman, who lives near Hebron. He said, “For me Abraham is philosophy, Abraham is culture. Abraham may or may not be historical. Abraham is a message of loving kindness. Abraham is an idea. Abraham is everything. I don’t need flesh and blood.”

Excerpts from *Genesis*, by Robert Alter, copyright © 1997 Robert Alter, with permission of the publisher, W. W. Norton & Company, Inc.



Telling their sacred stories in Jerusalem, Muslims (above), Christians, and Jews (below) see themselves as actors in the story too. In this drama God creates the world, banishes Adam and Eve from the Garden, brings forth a great flood, and then commands Abraham to embark on a historic mission. Muslims believe this mission was revealed to them through Muhammad, a descendant of Abraham's son Ishmael (see genealogy, far left). Jews claim they inherited God's blessing through Abraham's son Isaac and his son Jacob. Skeptics say these stories are pure fiction, written for tribal self-glorification. If so, believers counter, why dream up such a fractured family tree that potentially muddles who really received God's blessing?





ointing toward heaven, houses in Haran, in southeastern Turkey, hint at the landscape that welcomed Abraham 4,000 years ago. Although the Bible says nothing about why Abraham had left his birthplace, Ur of the Chaldees, a Jewish story fills in the blanks: King Nimrod had seen a sign in



the stars foretelling a man who would rise up against him and his pagan religion. Persecuted by Nimrod, Abraham fled to Haran, where God first spoke to him: “Go forth from your land and your birthplace and your father’s house to the land I will show you. And I will make you a great nation.”

"GO FORTH... AND YOU

And Terah took Abram his son and Lot son of Haran, his grandson, and Sarai his daughter-in-law . . . and he set out with them from Ur of the Chaldees toward the land of Canaan. (Genesis 11:31)

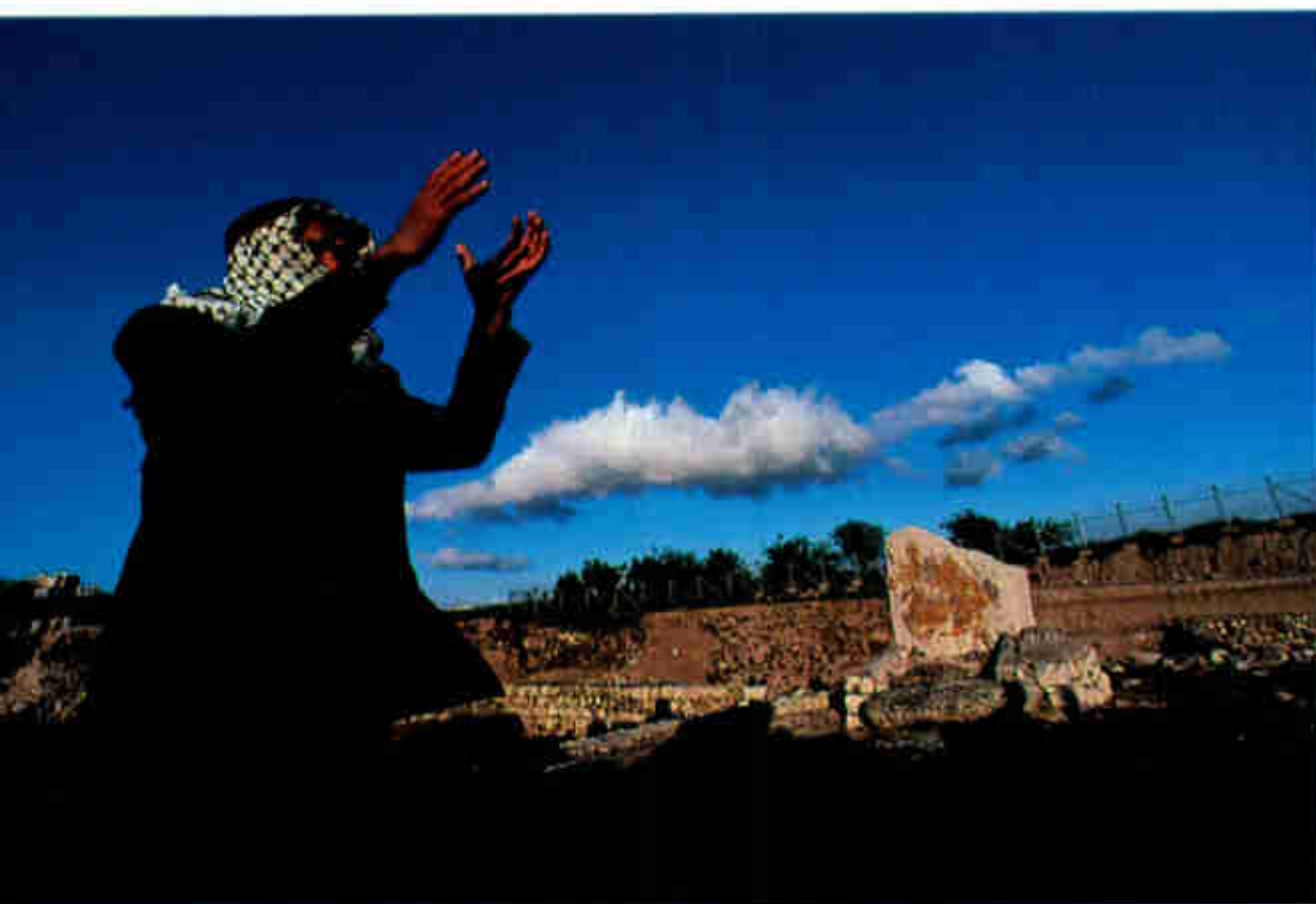
MY PURSUIT of Abraham began with a 500-mile taxi ride from Amman, the capital of Jordan, to Baghdad, in Iraq. This was followed by a 200-mile dash southeast through a wasteland of sand and scrub grass. Crossing the Euphrates River, I passed through a half dozen military checkpoints, arriving at last in Ur, widely believed to be Abraham's birthplace. My first impression was one of utter disappointment: Ur was dusty and forlorn, with no discernible pulse. The only visual point of reference was the pyramid-like brick tower, or ziggurat, built in tribute to Sin, the moon god, around 2100 B.C.

A sharp east wind arose as Dheif Mushin guided me around the site of the ancient city, which covered about 120 acres. Founded sometime in the fifth millennium B.C., Ur was unearthed during the 1920s and '30s by an expedition under the British archaeologist Leonard Woolley. Along with the ziggurat the

team found royal tombs and the remains of houses on city streets, which Woolley gave such incongruous names as Church Lane and Paternoster Row. The tombs held scores of stunning objects in gold, silver, and precious stones, confirming that Ur was at the heart of a rich and powerful civilization.

"This is the house," declared Mushin, a slim, blue-eyed man of 41. We had come to the corner of Church Lane and Broad Street and were staring into a shallow pit near the remains of the palace of Ur's glorious third dynasty, which lasted from 2100 to 2000 B.C. In the pit were a square stone floor and partly restored walls—the ruins of one of the largest houses Woolley excavated in Ur—dating from between 2000 and 1595 B.C. Woolley made much of his "discovery" of Abraham's birthplace, for which he was knighted. Although the possibility that Abraham had actually lived in this house was remote, I couldn't help but be excited by the thought.

"You must imagine Ur as it was," Piotr Michalowski, an authority on ancient Mesopotamia at the University of Michigan in Ann Arbor, told me before I left for Iraq. "In the third millennium Ur was the metropolis of Mesopotamia—a port on the Euphrates very close to the Persian Gulf." The river brought



Into Canaan they came, Abraham and his family and all their belongings. And the Lord appeared to Abram and said, "To your seed I will give this land." In thanks, Abraham built an altar to the Lord in Shechem (left), where several altars have been unearthed. "Is any one of them Abraham's?" asks Eric Cline, a biblical archaeologist. "Your guess is as good as mine. There are no plaques that say, 'Abraham slept here.' In fact, we can't determine if he ever existed. Abraham is a matter of faith." How then do you map the migrations of such a man (opposite)? With scriptures in hand and a humble heart.

SHALL BE A BLESSING."





When famine struck the land of Canaan, Abraham and his family went west, seeking sustenance in Egypt. Crossing the Sinai desert (above), Abraham came to fear that his wife Sarah's great beauty could bring him harm: Pharaoh might kill him and seize her. "Say, please, that you are my sister,"



Abraham pleaded, “. . . and I shall stay alive because of you.” When Sarah complied, Pharaoh took her as a concubine, for which the Lord punished him with plagues. Pharaoh banished Abraham and Sarah, who left Egypt with silver, gold, and cattle—yet still no children of their own, despite God’s promise to them.

rich alluvium down to Ur, creating a floodplain that gave generous sustenance to a population of perhaps 12,000 at the city's peak around 2100 B.C. Since then, said Michalowski, the coastline retreated a hundred miles, leaving Ur behind—to the sands.

We owe our knowledge of the region to the Mesopotamians, who invented cuneiform writing around 3200 B.C.* They produced hundreds of thousands of clay tablets and cylinders chronicling life; Ur alone has yielded thousands of texts just from the third dynasty.

"We have many archives from about the 19th century B.C. dealing with seagoing enterprises," said Michalowski, who is editor of the *Journal of Cuneiform Studies*. "I see a thriving urban center, with bustling, narrow streets full of shops, where craftsmen were making everything from leather goods to precious ornaments. Ur was a major commercial center—one might think of Venice in later days." Traffic in river vessels and cattle carts

would be the intellectual milieu he grew up in."

I see Abraham developing into a tough, compact young man with evident leadership skills. He may have worshiped Sin, the god of the moon and Ur's chief deity. "Mesopotamians worshiped a pantheon of deities, including major ones like Sin," said Michalowski, "but each person also had an additional, personal god." I wondered if, somehow, Abraham's reflections on the moon god had led him to the idea that the world is governed by one God.

IN MY QUEST for Abraham, divine inspiration would have helped. It was frustrating to find myself continuously suspended between different sets of legends—like virtual realities—with no facts to direct my investigation.

For the scriptural recorders the concept of time was so elastic that Abraham's family history strains credulity. In Genesis the entire story of Abraham's lineage is told in breathless,

I WONDERED IF ABRAHAM'S REFLECTIONS ON THE MOON GOD HAD LED HIM TO THE IDEA THAT THE WORLD IS GOVERNED BY ONE GOD.

and donkey caravans linked Ur and Mesopotamia with present-day Iran, Turkey, and Afghanistan, as well as with Syria, Israel, and Egypt. Date palms grew in the countryside, and irrigation canals from the Euphrates and the Tigris, which then flowed closer to the city, made farming possible: barley, lentils, onions, garlic. Sheep and goats supplied ghee and wool.

It was beguiling to think of an Abraham growing up in Ur—I imagine a thin teenager of middle height, dressed in comfortable leather and wool, going to school, playing with his brothers, Nahor and Haran, and their friends. "Only a very small proportion of the population could read and write," said Michalowski. "If Abraham was literate, that would mean he had taken schooling at the house of a priest or bureaucrat who would have taught him a broad range of skills. He would have studied languages, arithmetic, and accounting, but above all else he would have been immersed in Sumerian literature. This

compressed language, starting with Noah and the flood, then proceeding with Noah's son Shem and Shem's brothers and their progeny. If this genealogy is taken literally, it would have covered centuries—ten generations from Noah to Abraham.

Given the vacuum of evidence, it is understandable that historians and archaeologists are locked in debate about the patriarch's existence and time of birth. Abraham Malamat, a spry septuagenarian who is emeritus professor of Jewish history at Hebrew University in Jerusalem, believes Abraham may have lived sometime between 2000 and 1800 B.C. "The Bible and the entire body of ancient Israelite history make this the most plausible time frame for Abraham," Malamat told me one snowy evening in his Jerusalem apartment. "We are possibly the closest people on the subject. A historian is closer than an archaeologist."

Israel Finkelstein, who is chairman of the
*See "The Power of Writing," by Joel Swerdlow, NATIONAL GEOGRAPHIC, August 1999.



Waiting for sunrise, 70-year-old Bedouin Muhammad Khuder sticks close to the Sinai and semi-nomadic traditions that are on the wane. Most Bedouin no longer rely on goats or an orchard for survival, although this work does provide a fallback when cash-paying jobs are scarce. In ancient times, observes Talmudic scholar Louis Ginzberg, nomadic life could be tough. “[It] interferes with the growth of the family, it lessens one’s substance, and it diminishes the consideration one enjoys.” Yet God promised Abraham the opposite: a land in which to dwell, a life long in years, and children. “Look up to the heavens and count the stars, if you can count them,” says the Lord. “So shall be your seed.”

archaeology department at Tel Aviv University, argues that written documents are not the only source for reconstructing history. “In the past 20 years archaeology has become the main tool for studying the earliest phases of ancient Israel. Archaeology is sometimes the only tool.” There is no archaeological evidence, Finkelstein says, that camels—which are often described in Genesis as beasts of burden—were widely used for carrying goods until after 1000 B.C. He sees this as but one clue that the way of life reflected in the stories about Abraham is that of a much later time than the period of 2100 B.C., which some scholars arrived at by studying lineages in the Bible. “Whether there was a historical Abraham or not, I cannot say. But much of the reality behind Abraham in Genesis should probably be dated to the seventh century B.C.”

Ur is another case in point. The writers of

Genesis refer to it as Ur of the Chaldees, but scholars agree that the scriptures are confusing, because the Chaldees did not appear in Mesopotamia until early in the first millennium B.C. Finkelstein suggests this is further confirmation that the Genesis stories emerged at that time, as the people of Judah sought to build a national identity in a hostile world.

I asked Abraham Malamat about these confusions. “There are anachronisms like the camels—you might have a few anachronisms—but this doesn’t destroy the overall picture.” Rather, he says, these inconsistencies should be seen as later additions by biblical writers and therefore as hardly relevant for dating purposes.

Amid all the uncertainties, one thing seemed clear as I climbed the famous ziggurat in Ur with Dheif Mushin: To the ancients the three-tiered tower must have been a mighty symbol



Heading east from Egypt, toward tributaries of the Salt Sea (the Dead Sea, above), Abraham and his family traveled with his nephew, Lot. Knowing the land could not sustain both families dwelling together, given their large herds of cattle, Abraham said to Lot, “Let us part company. If you take



the left hand, then I shall go right, and if you take the right hand, I shall go left.” *Lot chose the fertile plain of Jordan to the east, so Abraham went west, returning to Canaan—but as a changed man: In Egypt Abraham had focused only on his own fate, but here the patriarch becomes a peacemaker.*

of the solidity of traditional beliefs. The great monument brought me closer to understanding the magnitude of Abraham's break from those beliefs. We can never know, but perhaps his early experiences in Ur prepared him for the spark of inspiration that carried him—and humanity—on a great journey.

IN ANCIENT MESOPOTAMIA as in the Middle East today, armed conflict was frequent. Cuneiform texts record an attack by Elamite armies from present-day Iran around 2000 B.C., and a disruption of this kind may have contributed to Abraham's leaving Ur. Whatever the reason, Genesis tells us that he left *toward the land of Canaan* with Terah, Sarah, and his nephew, Lot, and *they came to Haran and settled there*.

"Settling and starting off again, waging war and making peace, fighting battles and concluding treaties"—this was to be the basic rhythm of Abraham's life, writes Karl-Josef Kuschel, a theology professor at Germany's University of Tübingen. The 600-mile journey from Ur must have taken the family and their caravan of donkeys several months as they progressed northward up the Euphrates Valley to Haran. The city lay on the banks of the Balikh River at the crossroads of important trade routes in the Fertile Crescent. Like Ur, it was a major center of worship of the moon god, Sin.

In Haran, Abraham would have found himself in the midst of a clamorous community of Amorites, Hurrians, and other ethnic groups. Haran today is a dusty Turkish village of around 500 people living in beehive-shaped clay houses, joined by arches to increase the shade and air circulation. Numerous archaeological excavations show that builders in ancient times also sought, by using thick walls and wide-open yards, to moderate the effects of temperatures that can exceed 120°F.

With Aydin Kudu, a young guide from Istanbul, I visited the remains of a house on a small hill in the center of Haran, where, according to local legend, Abraham lived. Judging from its configuration, this spacious construction had belonged to a large and prosperous family. Sitting on a low wall, Aydin and I speculated that Abraham's family must have been quite affluent during the years they lived in Haran.

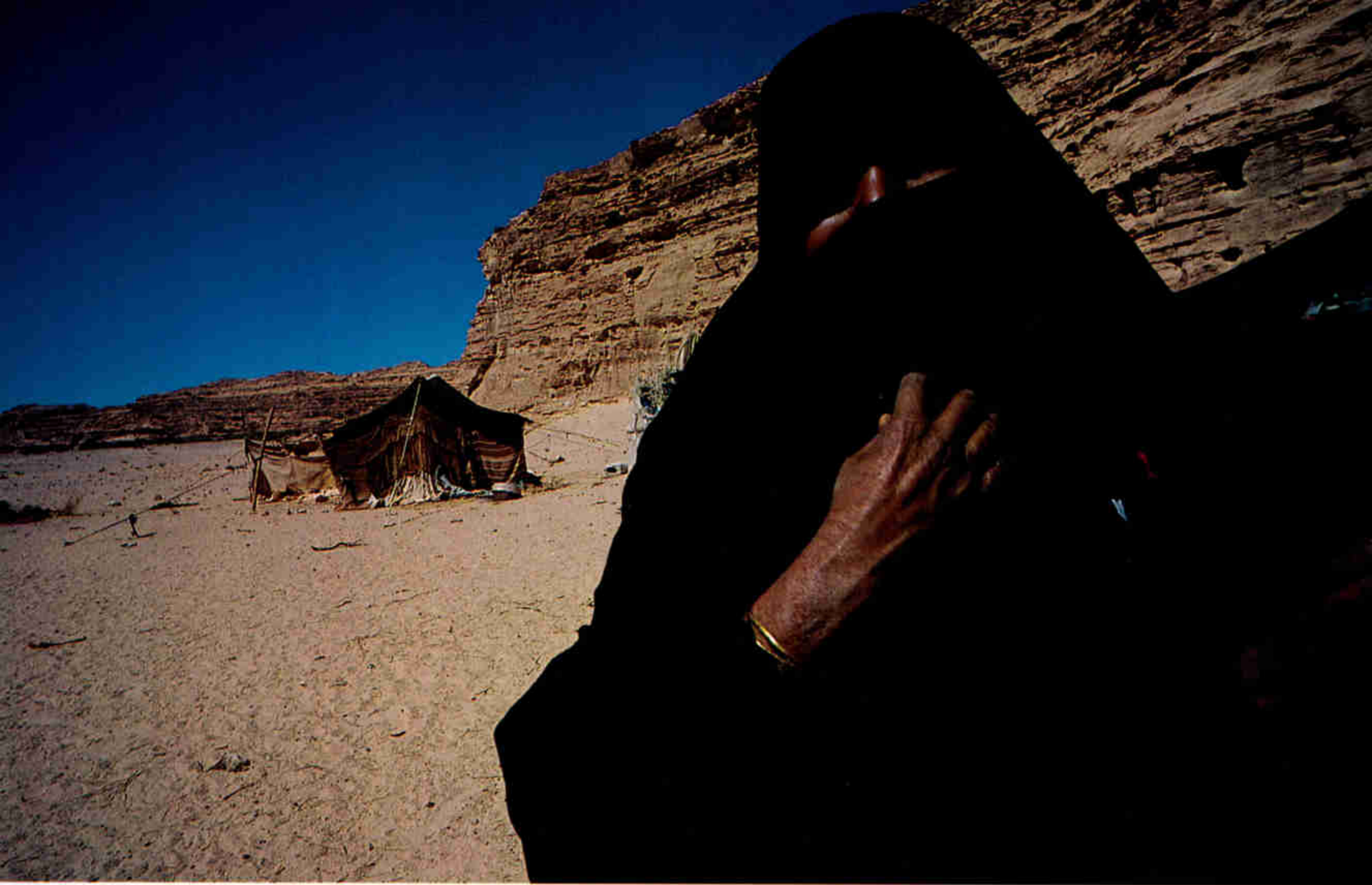
After Terah, his father, died, Abraham, as paterfamilias, would have supervised the family's flocks, traded wool for wheat with farmers, and recruited local people for his growing clan. Seeing the multitude of sheep around Haran, it struck me that the scene today was probably not very different from that in Abraham's time.

Later, I tried to extract at least one new Abrahamic legend out of Suleyman Sançar, a village elder. Sançar, a dignified 63-year-old Muslim with an impressive white beard, had invited me to his house for ceremonial tea and pita bread with a few friends. But all I got was the suggestion that a king of the region early in the second millennium B.C. was Abraham's uncle. Such stories exist to please visitors, small groups of whom—mainly Christians—come by bus every week to search for Abraham's heritage.

If archaeology denies us any direct evidence of Abraham, Terah's name appears tantalizingly in cuneiform tablets. Ömer Faruk Harman of Marmara University in Istanbul cautions that "Terah" almost certainly is not a personal name. It is probably a clan name or the name of a town in extreme northern Syria or, more likely, southeastern Turkey, not far from Haran. Still, Abraham was a son of Terah, which may establish the connection between Abraham and Haran.

While in Haran I made a side trip to a place that claims its own intimate connection with the patriarch. Şanlıurfa (known as Urfa until World War I) is a pleasant, relaxed city of nearly half a million an hour's drive away. Some scholars believe that because Şanlıurfa is so much closer to Haran than Ur, it is the more logical candidate for Abraham's birthplace. Either way, paternity of Abraham is a boon to tourism, and the city has instituted annual Abraham festivals that swell city coffers.

Not surprisingly, Şanlıurfa is rife with legends about Abraham. One says he was born in a cave at the foot of a rock outcrop in the southern part of the city. According to this tale Abraham aged a month on the first day after his birth and turned 12 on his first birthday. His faith in a single God led him to smash figures of deities and idols. Furious, King Nimrod ordered Abraham burned, but a huge pool of water materialized, dousing the fire, and flaming logs turned into fierce fish that saved

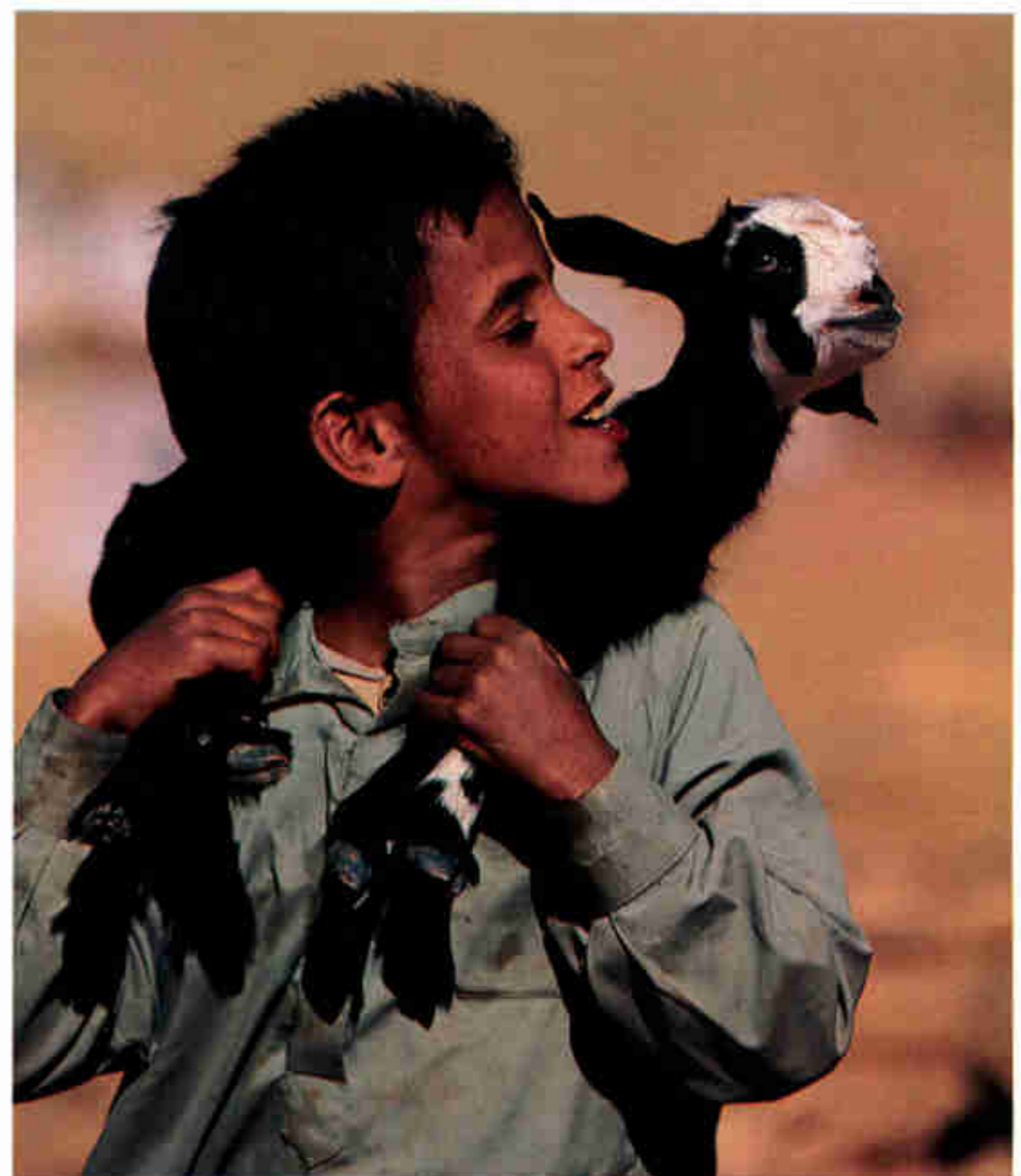


woman waits. She is anxious. Ninety years old, she is still childless. So Sarah makes a fateful decision: She tells her husband to conceive a child with Hagar, their Egyptian slave girl, who soon bears Abraham a son. His name is Ishmael. Soon Sarah is blessed with a son of her own. His name is Isaac. When God finally calls Abraham to his greatest test of faith—to offer his son as a sacrifice—which son is it? Isaac, say Jews and Christians; Ishmael, say Muslims. Even though neither son dies—God stays the hand of their father, who slays a ram instead—the conflicting narratives reflect a painful divide rooted in a cosmic competition: Which of Abraham’s children are truly playing the lead role in history’s divine drama?

Abraham. A few steps from the cave two large pools—Halil ür Rahman and Aynzeliha—symbolize the miracle. They are stocked with a plethora of fat carp that are believed to be sacred: He who eats Abraham’s carp will be struck blind.

Many of Şanlıurfa’s pilgrims come from Iran, and buses arrive a few times a week with Muslim worshipers, chiefly women, their heads covered with scarves. Worshipers enter the cave through a small mosque with a minaret, spend a few minutes inside praying, then leave. Some pray outside at the low stone wall around the mosque, bowing over it or prostrating themselves on the ground. The afternoon of my visit, a lone elderly woman in a black head scarf was praying at the wall as lightning flashed overhead.

Wherever Abraham was born—Şanlıurfa or Ur or somewhere else—it was in Haran,





animal sacrifice played a significant role in Jewish history from the time of Abraham until the time of Christ, when the Romans destroyed the Jerusalem temple. The practice endures on Mount Gerizim, the mountain holy to Samaritans, who still offer sheep as a sacrifice on the eve of the feast



of Passover (above). This ritual is rooted in the Samaritans' literal reading of the laws of Moses and their separation from mainstream Judaism, which abandoned such ancient rites long ago. Today only 600 or so Samaritans remain, living precariously between Israeli and Palestinian societies.



Expectations building as they stream along Ibrahim Street, Muslim pilgrims on the hajj arrive in Mecca, the nexus of Islam. According to the Koran adult Muslims who are physically and financially able must make a pilgrimage to this holy city at least once in their lifetime. Heeding the call, they come from every corner of the globe—to walk in the footsteps of Abraham, Hagar, Ishmael, and Muhammad and to worship Allah, the One. In his day Muhammad believed monotheism could be the antidote to the violent tribalism that tore at the Arab world, writes Karen Armstrong in *A History of God*. “A single deity who was the focus of all worship would integrate society as well as the individual.”



containing reproductions of a fresco painted in an ancient palace in Mari, Syria, about 200 miles southeast of Haran. Dating from the early second millennium B.C., which Malamat believes is the right period for Abraham, the palace—along with tens of thousands of cuneiform tablets—was excavated by a French expedition starting in 1933.

What I saw was a rather unheroic-looking man with brownish skin and a small black beard. He is wearing a black cap with a white headband, and the two-horned head of a sacrificial bull reposes by his lap. “His face is characteristic of the western Semitic type,” Malamat said. “So are the cap and the bull. I think it most likely that Abraham descended from western Semitic nomadic tribes, probably from Syria or southern Mesopotamia.

“This picture in my opinion comes close to Abraham,” Malamat continued. “Maybe he’s a concept, but his figure makes sense. There are pictures on the Mari walls, figures that may be close to Abraham, Isaac, and Jacob.”

It was the old conundrum: Without clear proof, the only thing you can ever say about Abraham is: “In my opinion.”

ABRAM being seventy-five years old when he left Haran. And Abram took Sarai his wife and Lot his nephew and all the goods they had gotten . . . and they set out on the way to the land of Canaan, and they came to the land of Canaan.

As best as can be reconstructed from imprecise maps of the ancient Fertile Crescent, Abraham traveled southwest from Haran across Syria, past Damascus. A large body of retainers would have accompanied him. Abraham’s crossing into Canaan gave me the sensation that I was emerging from a fog and beginning to see the historical landscape. Not only is Genesis a more detailed road map from this point on—it names Canaan and specific locations there—but history itself is reasonably explicit about the region and the people Abraham would have encountered in the Promised Land.

Flowing with milk and honey, as the Bible describes it, Canaan stretched roughly from Syria in the north to Egypt in the south. Canaanites produced an unusual purple dye

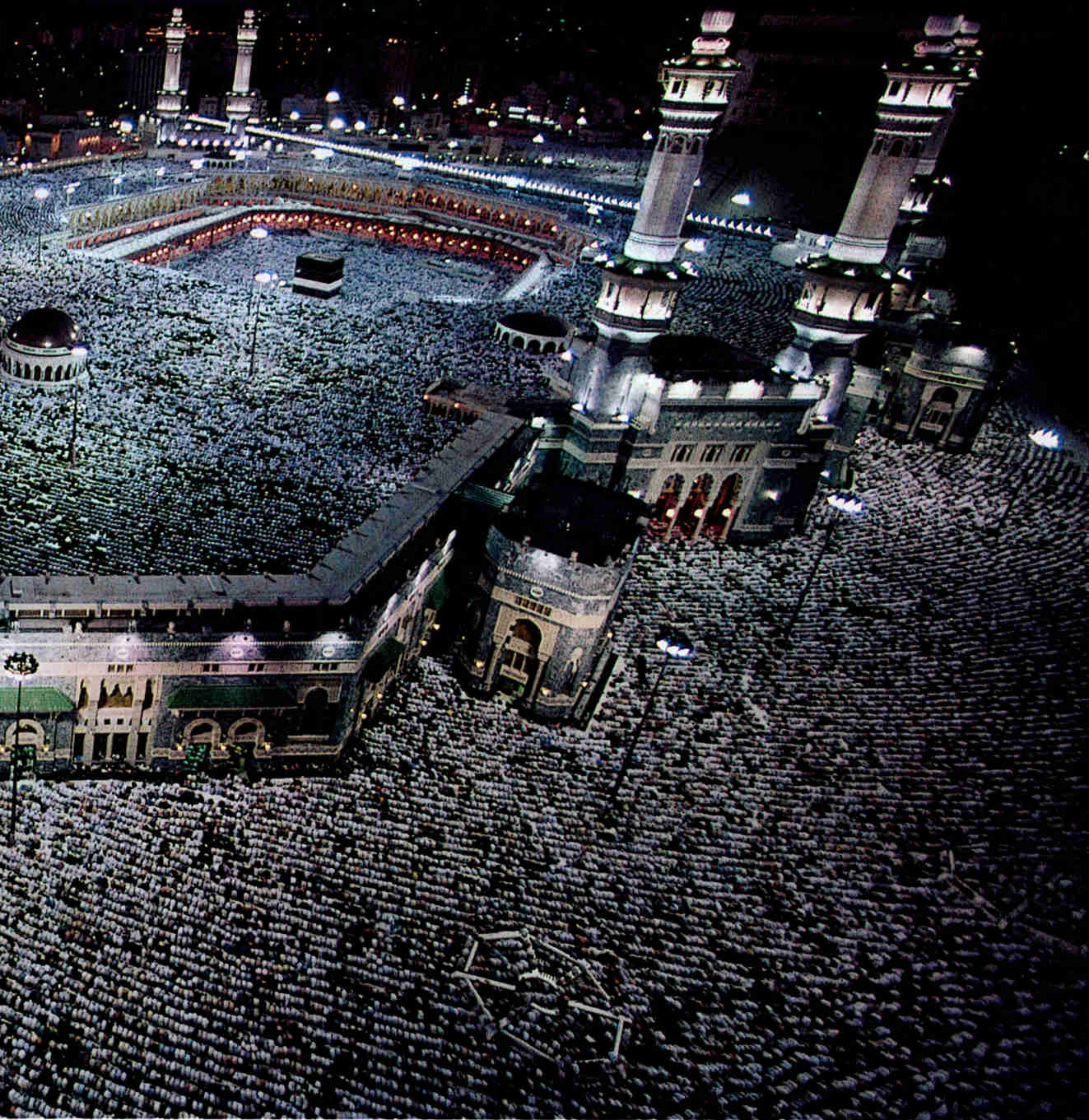
Genesis says, that he received the words that established his obedient relationship with God. Once again, he would have to leave his home. *And the Lord said to Abram, “Go forth from your land and your birthplace and your father’s house to the land I will show you. And I will make you a great nation and I will bless you and make your name great, and you shall be a blessing.”*

As Robert Alter of the University of California, Berkeley, writes, “Abram, a mere figure in a notation of genealogy and migration . . . becomes an individual character . . . when he is here addressed by God.”

The only time I came close to glimpsing the patriarch as an individual was in Jerusalem, when Abraham Malamat showed me a book



More than two million Muslims prostrate themselves at the Grand Mosque in Mecca each year during the hajj—“and it’s a wonderful experience, a joyful time,” says Abdullah Khouj, a Mecca native who was born near the mosque. “When people leave their worldly gains behind and come



to pray in simple white garments, you realize there's no difference between rich and poor, black and white. There's a sense of equality." And of wonder too: The huge influx of believers temporarily triples the city's population, straining the water supply. "Allah provides," Khouj explains. "And the Saudi government helps too."

made from shellfish, so much so that the region came to be called “the land of purple.” They were active traders—one meaning of “Canaanite” was “merchant”—and as such were subject to the influences of their flanking civilizations, Egypt and Mesopotamia. Around the time Abraham may have arrived, Mesopotamia was an especially important source of goods, people, and ideas.

And Abram crossed through the land to the site of Shechem, to the Terebinth of the Oracle, proclaims Genesis. Shechem is one of the oldest cities in the Middle East, dating from the beginning of the second millennium B.C. Situated west of the Jordan River, it is today’s Nablus, a bustling city of 130,000 under the control of the Palestinian Authority. In Shechem, God appeared to Abraham, saying, “*To your seed I will give this land.*” Genesis gives no response from Abraham but notes that *he built an altar to the Lord.*

As to Canaanite religion, Abraham would

Abraham remained in Shechem. All we learn is that from there he *pulled up his stakes . . . for the high country east of Bethel and pitched his tent with Bethel to the west and Ai to the east, and he built there an altar to the Lord, and he invoked the name of the Lord.* Some scholars believe that since Bethel was a Canaanite cultic site, the Bible, by directly connecting Abraham to it, provided a way for the Hebrews to claim it as their own.

From Bethel, the modern Arab town of Baytin, Abraham journeyed south to the Negev desert. It was mainly downhill traveling, over brushland and into the barrens. Irrigation makes the Negev bloom today, but in Abraham’s time a dry, rocky expanse filled the landscape between Beersheba and the Gulf of Aqaba. To make matters worse, an especially severe drought struck the Negev soon after his arrival, forcing him to move again. *Abram went down to Egypt to sojourn there, for the famine was grave in the land.* The attraction

ABRAHAM WAS SUMMONED BY GOD, WHO MADE EXPLICIT HIS CHOICE OF ABRAHAM AS THE “FATHER TO A MULTITUDE OF NATIONS.”

have encountered a fertility-centered religion with seasonal festivals and animal sacrifices. In Leviticus and Deuteronomy, the Bible portrays the Canaanites as idol worshipers who held human sacrifices and engaged in deviant sex, practices seen as a threat to an emerging monotheism, but neither archaeology nor Canaanite texts support this description of the Canaanites.

In Nablus I met up with Avner Goren, an archaeologist with an encyclopedic knowledge of biblical history. We went looking for evidence of Abraham’s Shechem but found nothing that could be tied to the patriarch. Everything seemed harmonious while we were there, but before long lethal battles would erupt between Palestinians and Israelis. Automatic arms’ fire would fill the air around the tomb thought to be that of the Prophet Joseph, Abraham’s great-grandson. Canaan is still a battlefield, as it has been on and off for thousands of years.

Genesis says nothing about how long

of Egypt was the Nile and its extravagantly fertile delta.

At this point Abraham must have been questioning God’s promises that he would give him a child and a homeland. He was still childless, and after reaching Canaan, he had been uprooted yet again.

ONE SPRING MORNING I drove from Cairo to Avaris, an archaeological site at Tell el Daba, where Abraham may have established himself. The area produces rice, corn, cotton, and, during the spring months, wheat. I was cordially received by Manfred Bietak, chairman of the Institute of Egyptology at the University of Vienna, who is leading the excavation of the site.

“Absolutely blank,” was his immediate reply when I asked what the Egyptian historical sources say about Abraham. “As far as the Egyptians are concerned,” he said, “it’s as if Abraham never set foot in the delta.”

The timing of Abraham’s arrival in the delta



n the eighth day of his life, Meir Kopshitz is circumcised, a sign of God's enduring covenant with the Jewish people. The oldest continuously performed Jewish rite, Brith Milah was a command to Abraham, who circumcised his sons—and himself, at the age of 99. This covenant—this partnership between Abraham's family and God—introduces a new idea into history, writes Rabbi Joseph Soloveitchik. "What happens to Jews emanates from a Divine promise foretold about the future, rather than by events impelling from the past. Jewish history is pulled, as by a magnet, toward a glorious destiny." What is that destiny? The messianic redemption of the entire universe.

is as indeterminate as where he settled. Some scholars believe that an Abraham figure could have come to Egypt at the time of the Hyksos (an Egyptian word meaning "foreign rulers") in the first half of the second millennium B.C., but most argue he would have been there much earlier.

Whoever the pharaoh was during Abraham's stay in Egypt, he was implicated in Abraham's life in the most intimate way. As Abraham approached the Egyptian border, *he said to Sarai his wife, "Look, I know you are a beautiful woman, and so when the Egyptians see you and say, 'She's his wife,' they will kill me while you they will let live. Say, please, that you are my sister, so that it will go well with me on your count and I shall stay alive because of you."*

Genesis continues, *and Pharaoh's courtiers saw her and praised her to Pharaoh, and the woman was taken into Pharaoh's house. That*

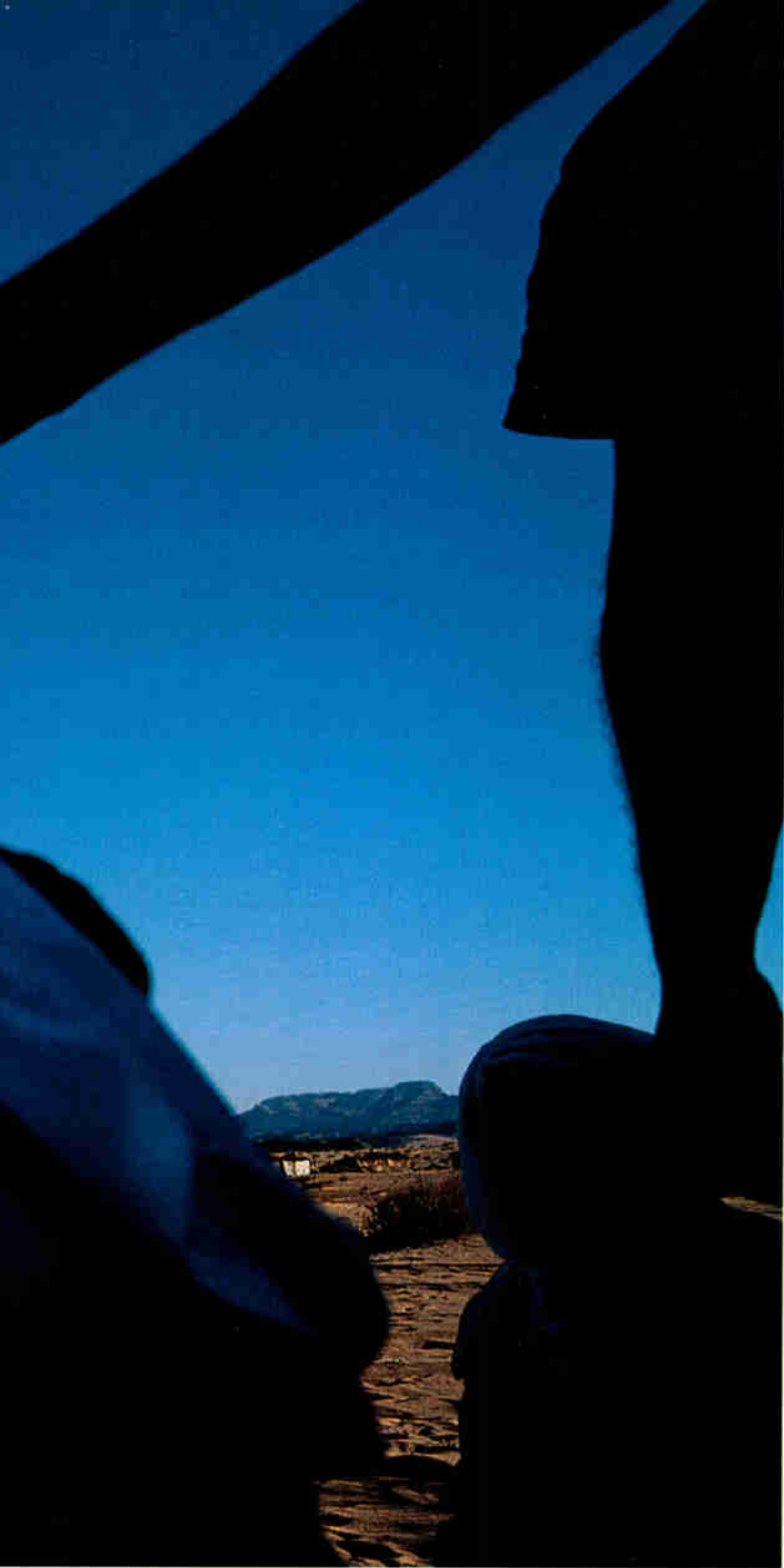
Sarah was no longer a young woman did not seem to have discouraged the pharaoh.

Genesis offers no moral judgments on this peculiar turn of events, nor does it go into any other aspect of Abraham's life when Sarah was presumably in the pharaoh's harem. *The New Jerome Biblical Commentary*, a compilation of largely Roman Catholic biblical studies, suggests that Abraham's deception calls into question his faith that God would protect him and fulfill the promise that, *To your seed I will give this land.* The *JPS Torah Commentary*, a Jewish analysis, makes the point that Abraham would have erred if he had expected God to work a miracle to get him out of this fix. As it turned out, God did intervene. *And the Lord afflicted Pharaoh and his household with terrible plagues because of Sarai the wife of Abram.*

The lack of detail about Abraham's behavior



Three men mysteriously appear outside the tent of Abraham, who graciously welcomes them with bread, milk, and a tender and goodly calf. The tradition of hospitality, friendship, and concern for the stranger lives on. “I have been shooting pictures for 35 years and have traveled in 107 different countries, but nowhere have I enjoyed greater warmth than I experienced among the Bedouin,” says photographer Reza. “Exhausted after a long day driving in the Sinai desert, you’d approach a tent, and suddenly someone would appear with coffee and a beautiful carpet to sit on—yet they’d never ask who you were or where you’re from. I sometimes wonder if the rest of us have forgotten such values.”



is a frustrating example of the gaps spawned by the transformation of oral traditions into the written stories of Genesis. If Abraham's deception is open to interpretation, the pharaoh's reaction was abundantly clear. *And Pharaoh summoned Abram and said, "What is this you have done to me? Why did you not tell me she was your wife? Why did you say, 'She's my sister,' so that I took her to me as wife? Now, here is your wife. Take her and get out!"*

ABRAM was a rich man when he left Egypt—heavily laden with cattle, with silver and gold. By now I see him, consciously or not, beginning to lay the foundation for the establishment of monotheistic religion. To understand Abraham's connection

with monotheism, says James Kugel of Harvard University, you have to look beyond Genesis itself, which says nothing directly about it. "Centuries and centuries after Abraham might have lived, there were interpreters who read his story in Genesis. These interpreters lived from around the third century B.C. on. When they got to chapter 12, they said, 'Oh, why does God start speaking to Abraham and promise him all these wonderful things, like making him a great nation?' Eventually they went to the Book of Joshua, where it says that Abraham's family all worshiped other gods." Kugel says the interpreters concluded that Abraham was the only one who didn't worship these other gods.

In numerous later works—including the Book of Jubilees (found with the Dead Sea Scrolls), the New Testament, early Christian writings, and the Koran—Abraham is presented as a model of faith and pure monotheism. The idea caught on and became fixed.

After returning to Canaan, Abraham settled a land dispute between his herdsmen and those of his nephew, Lot, who had left Egypt with him. He did this not by fighting but by letting the younger man decide. Lot picked the verdant valley of the Jordan River down to the southernmost shore of the Dead Sea, where the cities of Sodom and Gomorrah stood. Abraham—known ever more as a peacemaker—was content to remain among the mountains and deserts of the Promised Land, making his temporary home under terebinth trees in Mamre.

By now God had appeared to Abraham, reconfirming his gift of the Promised Land. *"Raise your eyes and look out from the place where you are to the north and the south and the east and the west, for all the land you see, to you I will give it and to your seed forever. . . . Rise, walk about the land through its length and its breadth, for to you I will give it."*

In the ancient Middle East, walking around a property was a ritual for taking final possession of a piece of land. Genesis makes no mention that Abraham fulfilled God's order to walk about the land. But the *Genesis Apocryphon*, an interpretive text found in the 1940s among the Dead Sea Scrolls, fills in this blank, describing at length a journey

Abraham made around the Promised Land.

To show his gratitude to God, Abraham built an altar in Hebron, which lies in a hollow in the mountains of Judah some 15 miles southwest of Jerusalem. Although Israel largely withdrew its military forces from the overwhelmingly Arab city in January 1997 as part of the peace process with the Palestinian Authority, the Israeli government kept control of a strip including a small Jewish neighborhood along al Shuhada Street in the center of the old town. Some 450 Jews live on al Shuhada Street (with 210,000 Arabs around them), which was closed to Arab traffic and guarded at either end by Israeli soldiers. I found it eerie driving along the silent, empty street, with the storefronts shuttered.

In Hebron, Abraham suddenly found himself an active military commander. An emissary brought him word that Lot had been captured in Sodom by four warmongering kings. Genesis, which at times is very precise, recounts that Abraham marshaled 318 of his retainers and struck the enemy at night, chasing them north past Damascus in Syria and freeing Lot.

Returning in triumph, Abraham reached Salem—the town that most likely became Jerusalem, sacred to Jews, Christians, and Muslims. It may have been there that he had a “conversation” with God in which he expressed his doubts about the divine promises. As Robert Alter of UC Berkeley points out, “This first speech to God reveals a hitherto unglimped human dimension of Abram.” God’s promise of a very great reward prompted Abraham to complain about what he thought had been the Lord’s failure to fulfill earlier pledges. He said, “O my Master, Lord, what can You give me when I am going to my end childless. . . . to me you have given no seed.”

God replied, “Look up to the heavens and count the stars. . . . So shall be your seed.”

On that day, Genesis says, God made a covenant with Abraham: “To your seed I have given this land from the river of Egypt to the great river, the river Euphrates.”

From Salem, Abraham went to Mamre and Hebron, where he now spent most of his time. I visualize him as a grand old man, sitting under a tree, dispensing wisdom, overseeing the family finances, and, of course, talking with God.

AT THIS POINT Genesis records an event that would profoundly influence the course of world history. In the ancient Middle East wives who could not bear children encouraged their husbands to procreate with slaves or concubines. Thus Sarah, who was barren, convinced Abraham to have a child with Hagar, an Egyptian slave who had probably stayed with them since the clan’s expulsion by the pharaoh.

The birth of Ishmael, Abraham’s first son, foreshadowed the emergence in Arabia in the seventh century A.D. of a new religion—Islam—under the guidance of the Prophet Muhammad. The Koran calls Abraham’s first son *an apostle (and) a prophet. . . . He was most acceptable in the sight of his Lord.* Ishmael’s pedigree lent legitimacy to the new faith, but the Koran never mentions Hagar’s name.

Abraham first, then Ishmael, are the perfect models of piety for Muslims. Abraham’s name appears in 25 of the 114 chapters of the Koran, and to this day Ibrahim and Ismail are common first names among Muslims. “The Koran explains that all true revelations come from God,” says John Voll, professor of Islamic history at Georgetown University’s Center for Muslim-Christian Understanding. “It is the record of the divine revelation, which is shared by all the scriptures.”

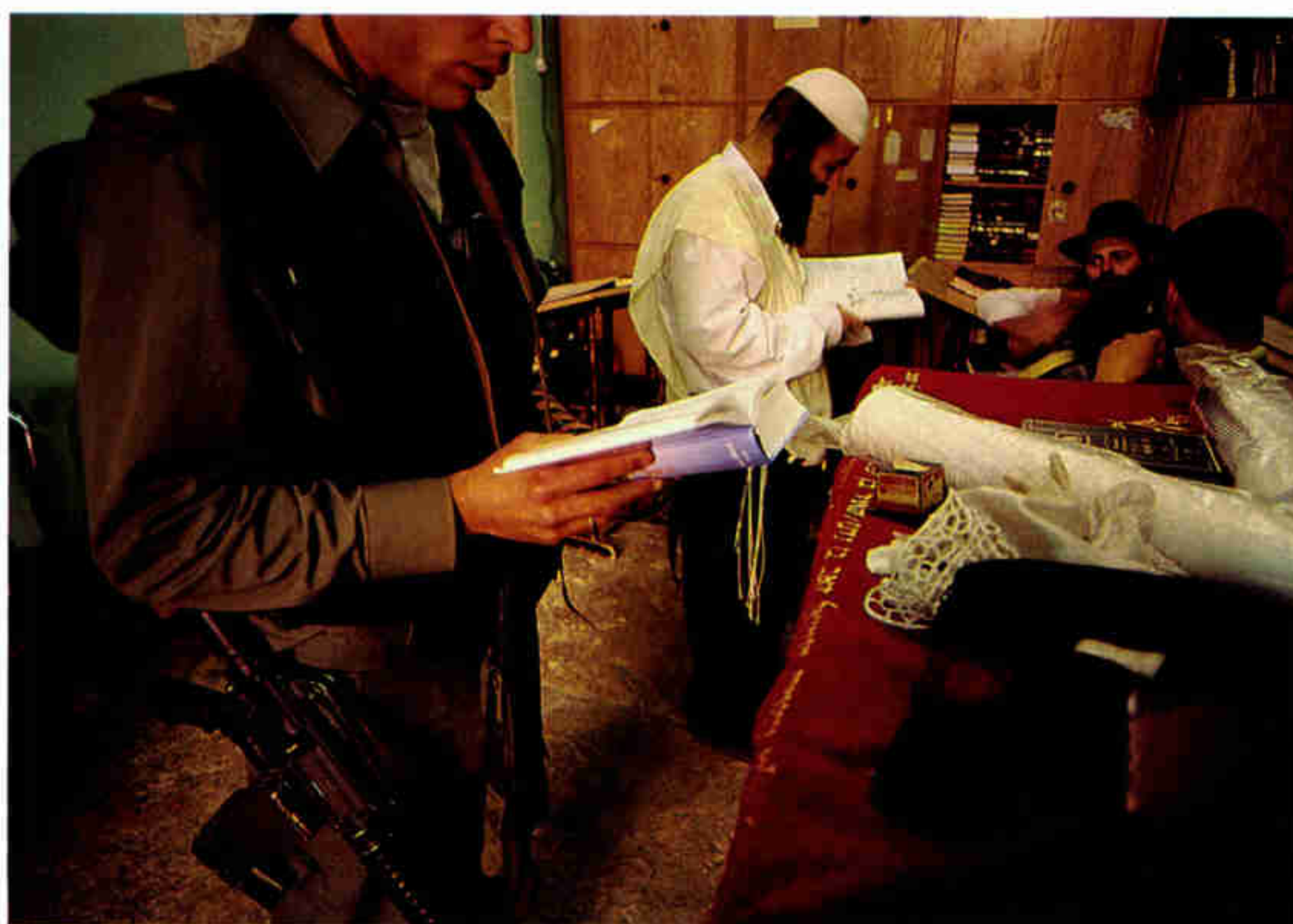
There is no doubt that Muhammad and his inner circle of disciples believed in Abraham as the founder of their faith. The Koran orders Muslims to follow the religion of Abraham. *Abraham was not a Jew nor yet a Christian; but he was true in Faith, . . . and he joined not gods with God.*

Muhammad was born in Mecca around 570. There he was surrounded by Jewish and Christian communities—although Muslims do not believe that these faiths influenced the revelation of Islam. In 622 Muhammad moved to Medina, where his following quickly grew. He was recognized as the last in a series of prophets, including Adam, Abraham, Moses, and Jesus, all of whom appear, redefined, in the Holy Book of Islam.

The Koran reports that *Abraham and Isma’il raised the foundations of the House.* The “house” is the Kaaba in Mecca, Islam’s holiest shrine. One of the four corners of this small rectangular structure is a sacred black



Seismic center of an ongoing spiritual earthquake, Jerusalem's Dome of the Rock encloses the tip of Mount Moriah (above) but can't contain its reverberations. Here Abraham nearly sacrificed his son Isaac. Here Solomon and Herod built their temples. Here Muhammad ascended on a night journey to heaven. And so Jews and Muslims, Israelis and Palestinians claim the site as part of their patrimony. So too Hebron's Cave of Machpelah, reputed burial place of Abraham, Isaac, and Jacob. Divided in two—with one sanctuary for Muslims, another for Jews (below)—the tomb stands as a testament to a living family, separated by history, now struggling to resolve its historic stalemate.





he dynamite strapped to these Hamas militants is fake, just a prop for a protest in Gaza's Jabaliya refugee camp. But the suicide bombers of Hamas—the Islamic Resistance Movement—are no illusion. With their own radical interpretation of the Koran in hand (above), these extremists seek to



kill Israeli troops and civilians in order to force the “Zionist entity” out of Palestine. Middle East specialists debate the extent of support for Hamas attacks in the region, where antipathy for Israel runs high—but where the Koran, with its strictures against the killing of innocents, is revered as the Word of God.



In the land promised to Abraham's seed, a bitter cycle of violence grinds on. In a Palestinian refugee camp in Gaza last April, the Israeli army bulldozed homes (above) said to harbor snipers. Months earlier, Israelis buried one of two soldiers (below) lynched by a Palestinian mob. In the wake of such heartbreak come the tears, soon followed by the diplomats, whose complex political fixes root poorly in a land long leavened by divine decrees. Whoever believes in God . . . should do good to his neighbor, said the Prophet Muhammad. "When a stranger sojourns with you in your land," God commands the Israelites, "you shall do him no wrong . . . and you shall love him as yourself."



ILKKA UIMONEN, CORBIS SYGMA

stone that is a remnant of the original building. The annual pilgrimage to Mecca, the hajj, when Muslims from all over the world circle the Kaaba, reinforces the central role of Abraham and Ishmael in the Islamic faith.

The Koran does not give particulars about the birth of Ishmael, but Genesis goes into great detail. It reports that after Hagar became pregnant, Sarah resented her. She complained to Abraham that when the Egyptian “*saw she had conceived, I became slight in her eyes,*” and she went on harassing the girl. Abraham replied meekly, “*Look, your slavegirl is in your hands. Do to her whatever you think right.*”

Consequently Hagar fled from Sarah into the desert wilderness. Sarah’s motivations are blurred, but what intrigues Rabbi Adin Steinsaltz is that she acted independently of Abraham when circumstances required. As the rabbi put it, Sarah and Abraham were as much partners as a married couple, and “she would allow Hagar to be an instrument of procreation but would not allow her the honor and privilege of being Abraham’s beloved wife-companion.” By law, Steinsaltz said, “women were quite independent. They had the right to own property, and they had standing. Sarah had a say, in one way or another.” I asked him if this makes Sarah the first great feminist. “Yes,” the rabbi shot back.

God, for his part, took another view of the situation. An angel intercepted Hagar when, apparently heading home to Egypt, pregnant, she stopped at a spring near Kadesh in the Negev. Hagar told the messenger she was fleeing from Sarah, but the angel ordered her to “*return to your mistress and suffer harassment at her hand.*” As a consolation the angel said to Hagar, “*Look, you have conceived and will bear a son and you will call his name Ishmael for the Lord has heeded your suffering.*” Hagar obeyed. Ishmael (whose name in Hebrew means “God has heard”) was born. Abraham was said to be 86 at the time.

Thirteen years after Ishmael’s birth the 99-year-old Abraham was summoned by God, who made explicit his choice of Abraham as the *father to a multitude of nations*. To symbolize the significance of this new, exalted status, God changed his name from Abram to Abraham. God also changed the name of his wife, Sarai, to Sarah. Then God announced

that “*I will also give you from her a son,*” and upon hearing this, *Abraham flung himself on his face and he laughed, saying to himself, “To a hundred-year-old will a child be born, will ninety-year-old Sarah give birth?”*

In their next meeting, God appeared to Abraham when he was sitting outside his tent. Looking up, Abraham saw three travelers among the trees. In a customary display of hospitality to strangers, he fetched water to wash their feet and treated the visitors to curds and milk and a calf he had cooked. Waiting on them as they ate (the scene depicted in Rembrandt’s famous etching “Abraham Entertaining the Angels,” owned by the National Gallery of Art in Washington, D.C.), he heard God repeat the promise that Sarah would have a son. Sarah, who had been listening from inside the tent, laughed inwardly, expressing her doubts. “*After being shriveled, shall I have pleasure, and my husband is old? . . . Shall I really give birth, old as I am?*”

AFTER PLAYING HOST at Mamre, Abraham moved from Hebron back to Beersheba. Within a year his son Isaac (“he who laughs” in Hebrew) was born. Abraham circumcised him on the eighth day, in keeping with God’s order that every male be circumcised.

Genesis then speaks of a second expulsion of Hagar. Sarah demanded this after observing the much older Ishmael playing and laughing with Isaac; she wanted to assure Isaac’s inheritance, even though he was not the firstborn. Now God took Sarah’s side, ordering Abraham to send Hagar and Ishmael away. He told him that “*through Isaac shall your seed be acclaimed. But the slavegirl’s son, too, I will make a nation, for he is your seed.*”

Hagar and her son were banished to the desert, but they were not alone. God provided for them, giving them a well of water when Hagar had lost all hope. Ishmael, Genesis says, *grew up and dwelled in the wilderness, and he became a seasoned bowman*. The Bible reveals little else except that his mother procured him an Egyptian wife and he helped bury his father. This is the last mention of Hagar. Muslim tradition holds that mother and son stayed together in Mecca, and they are said to be buried in a common grave—Hijr Ismail—next to the Kaaba.

Accompanied by Avner Goren, I followed Abraham to Beersheba. When we stopped at one Bedouin settlement, children rushed forward to beg: for water, not money. Abraham, too, needed water, and he dug a well in Beersheba, hoping to live in peace with the local inhabitants. He also planted a tamarisk tree, a symbol of plenty, invoking *the name of the Lord, everlasting God*. At this stage I envision Abraham as a full-time proselytizer and one-God activist.

The day of our visit to Beersheba was unusually raw; the Negev had just had more than half a foot of snow—one of the heaviest snowfalls in 50 years—and the whitened palm trees looked festive and beautiful. Beersheba was the patriarch's home for a number of years. A well said to be the one dug by Abraham still exists in the center of town, just off busy Hebron Road. (But it no longer provides water.)

Recognizing the city's spiritual importance, in 1979 Anwar Sadat, then president of Egypt,

When Abraham and Isaac reached their destination—which Jewish and Christian tradition holds to have been the Temple Mount in Jerusalem, the site today of the Dome of the Rock shrine—the patriarch erected an altar. He bound Isaac and placed him on a pile of wood on the altar. But when Abraham raised the cleaver to kill his son, God's messenger called out from the heavens, "*Do not reach out your hand against the lad, and do nothing to him, for now I know that you fear God.*" A ram, caught by its horns in a nearby thicket, was presented as a burnt offering instead of Isaac.

In the Koran, God similarly tests Abraham's faith by ordering the sacrifice of his son, but the son and the place are not named. In sura, or chapter, 37:102, 112 Abraham said, "*O my son! I see in vision that I offer thee in sacrifice.*" When Abraham shows his willingness to comply with God, he is promised another son, Isaac. *And We gave him the good news of*

IN A SENSE ABRAHAM NEVER DIED. ON THE HIGHEST RELIGIOUS LEVEL... JEWS, CHRISTIANS, AND MUSLIMS STILL REVERE HIM.

and Menachem Begin, the Israeli prime minister, came to Beersheba to begin peace negotiations between their two nations. But as Goren and I stood in the snow at Abraham's well, three Israeli Air Force F-16 fighter-bombers roared overhead. The message was plain: The Middle East is still far from real peace. Achieving it, repairing Abraham's fractured spiritual legacy, will demand an extreme act of faith from Palestinians and Israelis, whose common heritage is now a matter of scientific proof. A recent study of the DNA of male Jews and Middle Eastern Arabs—among them Syrians, Palestinians, and Lebanese—shows that they share a common set of ancestors.

THE ULTIMATE test of Abraham's faith in the only God appears to have arisen in Beersheba, when God ordered Abraham to take Isaac *to the land of Moriah and offer him up as a burnt offering on one of the mountains.*

Isaac—a prophet,—one of the Righteous. Most Muslims therefore believe that Ishmael was the one to be sacrificed and that this test occurred in or near Mecca.

In Genesis, Abraham returned to Beersheba. Sarah died in Qiryat Arba, near Hebron, at the age of 127. Abraham buried her in the Cave of Machpelah, in a tomb he bought for 400 silver shekels. He then dispatched a servant to the city of Nahor in northern Mesopotamia, near Haran, to find a wife for Isaac. Rebekah was the chosen woman. Back in Hebron again, Abraham had to be the busiest old man in all of Canaan. He found himself a new wife—a woman named Keturah, who gave him six children.

Abraham died at the *ripe old age* of 175. Isaac and Ishmael buried him in the Machpelah cave next to Sarah.

In a sense Abraham never died. On the highest religious level Abraham and his monotheism was a model for Jesus and his early Christian disciples and, much later,



If Abraham rose from his grave in Hebron and wandered its streets today, he would find a largely Palestinian city, mostly Muslim, and a small enclave of Jews who dwell near the patriarch's tomb. Bridging the divide between the "children of Abraham" requires far more than a family metaphor, writes theology professor Karl-Josef Kuschel, "since a 'healthy' family has individuality, rivalry, distance, and, in some circumstances, disputes and partings." Yet shared stories may help heal ancient wounds. In the words of Jewish poet Shin Shalom: "Ishmael, my brother hear my plea; / It was the angel who tied thee to me. / . . . Time is running out, put hatred to sleep. / Shoulder to shoulder, let's gather our sheep."

Muhammad and his Muslim followers. Today he still stands out as a unique spiritual figure, transcending the frontiers of great religions. However questionable the accuracy of the scriptures, however thin the archaeological and historical evidence, Jews, Christians, and Muslims still revere him as the patriarch.

One of the most touching expressions of devotion to Abraham I encountered on my travels was a short poem, "Hymn to the Blessing of Abraham," given to me at Istanbul Technical University. It was written by a Muslim, Cengizhan Mutlu, and tells of King Nimrod, who plotted to kill Abraham for his monotheism. My Turkish guide, Aydin Kudu, provided an impromptu translation.

*Idol made of pure gold
Gives no hope, no food.
Nimrod doesn't comprehend this.*

*Wood burns (for the stake),
Smoke reaches the sky,
Ibrahim is thrown into the fire.*

*He feels no pain, he doesn't groan.
He says, "My God will save me."
Two angels had said it rightly.*

*Embers turn into ashes,
Sparkles turn into roses.*

"My God will save me." In these five simple words is the essence of Abraham and his astonishing endeavors. They spell out his fundamental belief that there is one God. That belief changed the world forever. □

MORE ON OUR WEBSITE

"It's unbelievable how alive the story of Abraham is," says Reza. Watch his interview at nationalgeographic.com/ngm/0112.

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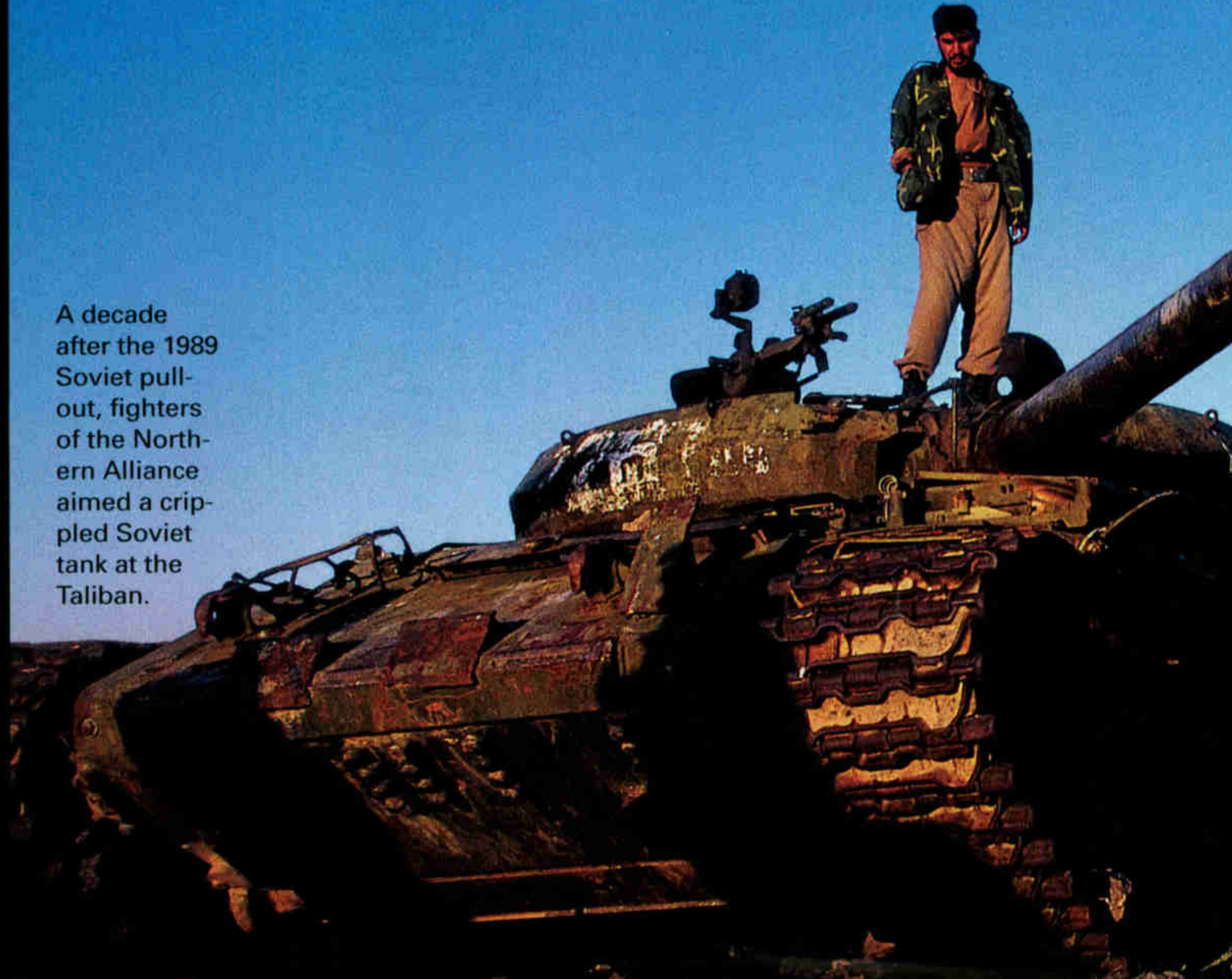
EYEWITNESS

A FIRSTHAND LOOK AT A BROKEN

AFGHANI

Just before the world's attention turned to Central Asia, veteran correspondent **EDWARD GIRARDET** returned to the country he had visited more than 40 times—and found murder, starvation, and despair.

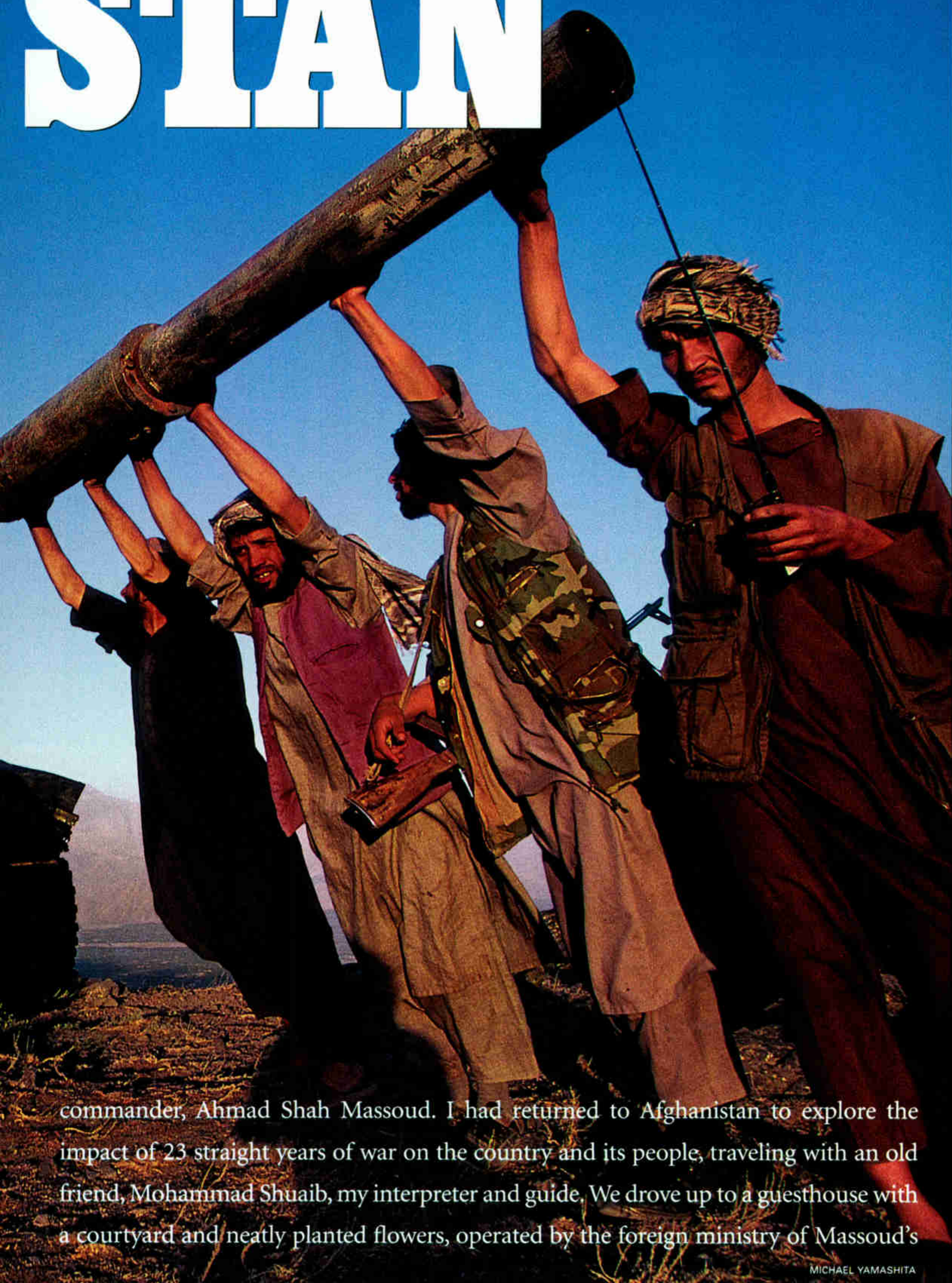
A decade after the 1989 Soviet pull-out, fighters of the Northern Alliance aimed a crippled Soviet tank at the Taliban.

A photograph showing a man in a camouflage jacket and light-colored pants standing on top of a heavily rusted and damaged Soviet tank. The tank is positioned in a dry, rocky landscape under a clear blue sky. The man is looking towards the camera. The tank's turret and main gun barrel are visible, showing significant wear and tear.

It was midafternoon when we pulled into the parched, dust-blown settlement of Khvajeh Baha od Din in northern Afghanistan. Once a bleak caravansary for nomads and traders, Khvajeh Baha od Din in early September served as the bustling rear supply base for the forces of Afghanistan's leading anti-Taliban

NATION, FROM PRE-SOVIET DAYS TO THE CHAOS OF SEPTEMBER

STAN



commander, Ahmad Shah Massoud. I had returned to Afghanistan to explore the impact of 23 straight years of war on the country and its people, traveling with an old friend, Mohammad Shuaib, my interpreter and guide. We drove up to a guesthouse with a courtyard and neatly planted flowers, operated by the foreign ministry of Massoud's

MICHAEL YAMASHITA

Northern Alliance. Asim Suhail, a young official wearing pressed jeans and shirt and tie with a blazer, looked up from his computer. As with all electrical appliances in a country debilitated by years of war and neglect, it only worked when the diesel generator was running. It also had to be covered constantly with a muslin cloth because of the ever penetrating dust. Asim immediately called for tea, studied our letters of recommendation, and smiled. "Of course, I know who you are and that you were coming."

Northern Alliance, also known as the United Front, and had radioed ahead requesting a meeting with Massoud. As the first American journalist, in 1981, to have interviewed Massoud, I had come to know him well. An ethnic Tajik from the Panjshir Valley, known as the Lion of Panjshir, he was in his late 40s, with a beard, sharply defined Roman nose, and broad, ready smile. He wore a Palestinian-style scarf and was never without a *pakol*, the floppy woolen cap that had become the trademark of the *mujahidin* (holy warriors) during their

AS THE FIRST American journalist to have interviewed Massoud, I had come to know him well.

There were several other journalists in the compound. A Russian from Prague-based Radio Liberty, an Uzbek from the London-based Institute for War and Peace Reporting, two French reporters, and two Arabs. There was also a group of American women on a fact-finding trip on the status of women in Afghanistan for the Feminist Majority in the United States.

I was somewhat surprised to see the Arabs, wearing jeans and T-shirts and surrounded by backpacks with the usual equipment of a television team. One didn't normally find Arab journalists reporting from the 15 percent of the country—mainly the north, with pockets of resistance elsewhere—held by groups opposing the Taliban. Given the large number of Islamic radicals from the Middle East and North Africa supporting the Taliban in Afghanistan, people in the opposition-held areas regarded Arabs with suspicion.

Curious, I asked them where they were from. "Morocco," said the older one, a somewhat severe man in his mid-30s with short hair and wire-rimmed glasses. "We're doing a TV report." When I asked which network, he shrugged: "A Middle Eastern one." He then withdrew to his room next to Shuaib's and mine. Asim later told me that they carried Belgian passports and had come with credentials issued by a London-based Islamic group. For the next three days, we lived side by side but saw little of them.

Shuaib and I had good connections with the

resistance against the Soviets in the 1980s.

With the Taliban and their radical Muslim backers, including the reclusive Saudi millionaire Osama bin Laden, seeking to create the world's first "pure" Islamic state by destroying what remains of Afghanistan's 3,500-year-old cultural identity, many Afghans regarded Massoud as the only man capable of someday uniting the various factions against the Taliban as they had once been united against the Soviets. I particularly wanted to discuss with him the impact of more than two decades of war. I also wanted further insight into what impelled the Taliban, whose support came not only from Afghanistan's Pashtun (also called Pathan) majority but also from an Islamic "foreign legion" of volunteers from Pakistan, the Middle East, and other parts of the Muslim world. These outsiders were believed to constitute about a third of the Taliban's fighting force.

I had interviewed Massoud on numerous occasions since 1981. Sometimes we met by gas lamp in hidden caves or shrapnel-scarred farmhouses among the side valleys of the Panjshir, with Soviet bombs and rockets crashing barely several hundred yards away. With the takeover of Kabul by the *mujahidin* in 1992, three years after the Soviets pulled out, we met in more comfortable surroundings in safe houses dotted around the city. The rockets still thudded around us, but this time fired by rival factions, including, later, the Taliban. Ironically, it was during the years following the Soviet withdrawal, when Massoud

couldn't control mujahidin infighting, that Kabul absorbed the greatest amount of damage, which virtually annihilated the city.

During one of our interviews over green tea and sugared almonds sometime in the mid-1990s, I asked Massoud what he wanted to do when the war finally ended. As usual we conversed in a combination of French and Dari, the Persian dialect spoken by many Afghans. "Read Persian poetry," he said, "and then go somewhere where there are no damn mountains."

Soon after Shuaib and I arrived in Khvajeh Baha od Din, heavy sand clouds began to envelop the mountains from the west—one of the results of a punishing three-year drought that has turned much of northern, central, and western Afghanistan into a dust bowl, with abandoned villages and arid fields. Combined with the terrible effects of seemingly endless war, Afghanistan was on the edge of famine. The UN, Oxfam, and other aid agencies had warned that the country could develop into a catastrophic humanitarian disaster by the onset of winter. Since spring of last year, when the rains had failed yet again, hundreds of thousands of Afghans had fled to towns inside the country or across the border into Pakistan and Iran in search of food and shelter. To survive, many had sold their remaining livestock and belongings, even their daughters in marriage—some as young as eight or nine.

Now, with the sand reducing visibility to less than 500 yards, the helicopters could not operate, and Massoud could not fly in from wherever he was. (Massoud's movements were always kept secret until the last moment for security reasons.)

"It could last a day, but it could drag on longer," said Mohammad Kamaludin, head of reconstruction for the Northern Alliance. He had come to Khvajeh Baha od Din in search of money for a slew of projects he had designed. "Everyone is obsessed by the war, but we must rebuild in those areas where there is no fighting," he told me. Numerous roads, irrigation canals, and other essential infrastructure were simply falling into dereliction for lack of maintenance. "If we do nothing now, there will be nothing left," he lamented.

When it was obvious that the dust was not

going to clear, Shuaib and I decided to leave. We would catch up with Massoud later. We were impatient to reach the Panjshir to see how things had changed in this 70-mile-long fertile valley once renowned for its mulberry and apricot trees. During the Soviet war many of its towns, villages, and irrigation ducts had been destroyed, rebuilt, destroyed again, and rebuilt again. Parts were also damaged during the more recent fighting between the Northern Alliance and the Taliban—until Massoud blew up the entrance to the valley, making it impossible for the Taliban fighters to enter by road.

Most, but not all, of the other journalists were also anxious to leave. Before heading off that morning, I spoke with one of the Moroccans as he returned from his morning ablutions,

CALLED the Lion of Panjshir for his tenacious defense of Afghanistan's most strategic valley during the Soviet war, Ahmad Shah Massoud until September led the last major military force opposing the Taliban. He was killed by assassins posing as television journalists.



REZA

a towel carefully draped over his head to protect him from the sand. "Will you try and go?" I asked. "This dust could persist for days." No, he answered. "We'll wait for Massoud."

Back in Islamabad less than a week later, on September 9, I heard the grim news over the BBC. An assassination attempt had been made against Massoud by two Arabs posing as journalists, the same two Moroccans I had met in Khvajeh Baha od Din. They were said to have packed explosives to their bodies as well as in the camera. One of them triggered the device as Massoud settled down for the interview. The Arabs reportedly died immediately as did Asim, the young foreign ministry official who had greeted us on our arrival. Massoud was dead, came a report. He was alive, came another.

Two days later the world's attention turned to the attacks on the World Trade Center and the Pentagon. It was clear to me that the timing of the attempt on Massoud's life was no coincidence. On September 15, Northern Alliance sources announced that Massoud had died of his wounds, and the next day Massoud was laid to rest as a hero at a funeral attended by thousands of followers in the Panjshir. An extraordinary era of hope and defiance had come to an end. It was also an era that heralded a new and uncertain future for Afghanistan.

sense of humor, often ridiculed them for wanting to get killed and being quite *diwana* (the Persian word for "silly" or "crazy") about it too.

In 1996 the Taliban took control of Kabul and then proceeded to occupy most of the country. Initially the security offered by the Taliban appealed to many Afghans tired of war. After the mujahidin takeover in 1992 warlords and armed gangs had set up roadblocks to "tax" travelers or, quite simply, to rob people at gunpoint. In the name of Allah, the Taliban halted this activity by confiscating weapons

IT WAS SEVERAL years before I learned that the tall man who threatened to kill me was Osama bin Laden.

This was my 40th-odd trip as a journalist to this Central Asian nation of mountains and deserts since I first began covering Afghanistan's dragging civil war, which erupted in Kabul in the summer of 1978. Three months before the Soviet invasion in December 1979, I had found myself in Kabul reporting what was then a low-key but steadily expanding conflict. Once the Soviets rolled in, I made repeated trips to the region, often traveling clandestinely with the mujahidin.

And once the Soviets came, so eventually did the U.S., with backing for the mujahidin to the tune of three billion dollars—funneled through Pakistan's military intelligence, which favored Pashtun-dominated fundamentalist resistance groups; little went to Tajik or Uzbek commanders such as Massoud. Wittingly or not, the U.S. intervention aimed at ousting the Red Army also helped Arab and other foreign Islamic militants establish themselves in Pakistan, creating a breeding ground for the Taliban's rank and file.

During the latter years of the Soviet occupation it was not uncommon to run into Islamic militants who had come to Afghanistan for what they saw as the only jihad (holy war) in the world. Armed with cash, but not necessarily military skill, they proclaimed a deep hatred for the U.S., Israel, and the "decadent" West. Desperately seeking to prove themselves as "soldiers of God," they tended to volunteer for frontline combat against the Soviets, regardless of risk. The Afghans, never without a

and punishing culprits by executing them or chopping off limbs. As the Taliban soon boasted without exaggeration, their authority enabled traders to travel from one end of Afghanistan to the other with a "truckload of gold" without being stopped.

This new sense of law and order, which many Afghans had not known for nearly 20 years, was evident when I visited Kabul in 1997. Driving to the Pakistani border, I came across only a handful of checkpoints, where I was frisked for weapons and my papers were examined. Earlier trips along the same route during the mujahidin era had required a multitude of stops where armed men, sometimes local villagers, placed a "toll" rope across the road and demanded some form of baksheesh, or "gifts."

By the time I returned last year, I found that bitter resentment had taken hold among Afghans against the Taliban's increasingly totalitarian Islamic policies, particularly in urban areas such as Kabul, Herat, and Jalalabad. Minority groups—Tajik and Uzbek prime among them—complained about discrimination, beatings, and even killings. Aid agencies particularly criticized the regime for its complete disregard for the plight of ordinary civilians and populations at risk; widows, for example, were prevented from working. Only in the tribal Pashtun areas of the southern and eastern parts of Afghanistan did the Taliban appear to retain considerable public support. But even this was beginning to erode. In some

eastern provinces sporadic but growing armed resistance was emerging against the Taliban leadership, based in the southern city of Kandahar. Some of the Pashtun commanders had joined the Taliban opposition, giving the Northern Alliance a broader—but still not inclusive—representation of Afghanistan’s ethnic and tribal groups.

Ever since Arabs first began converging on Afghanistan in support of the anti-Soviet jihad, many Afghans had been offended by the way the Taliban’s foreign Muslims, men like Osama bin Laden, treated them as ignorant provincials who did not understand what “true” Islam was all about. They had also chafed at edicts designed to curtail the country’s deep-rooted sense of culture and tradition, including a profound love for music and poetry—edicts banning everything from kite flying and music cassettes to women walking with loud shoes.

I first met bin Laden in February 1989, during the week in which the Soviets pulled out of Afghanistan. He was operating in the eastern mountains with a group of volunteers, mainly Arabs with a few Afghans. The factions that had united to push out the Soviets had already trained their guns on each other in a bid to gain control of the countryside; others were trying to dislodge the communist regime that still held Kabul, despite the Soviet withdrawal. Traveling with Afghan mujahidin,

I was scouting for a television documentary among the frontline positions manned by Arabs on the outskirts of Jalalabad.

A tall, bearded man, flanked by armed men, stepped up to me demanding—in good English, with a slight American accent—to know who I was and what I, a *kafir* (infidel), was doing in Afghanistan. For the next 45 minutes we had a heated debate about the war, religion, and foreigners. Haughty, self-righteous, and utterly sure of himself, he proceeded to lambaste the West for its feebleness and lack of moral conviction. When I pointed out that Western journalists and aid workers had been present in Afghanistan since the early days of the war, a time when no Arabs were to be seen, he spat dismissively.

Finally he announced that if I returned, he would kill me. A week later I did return, with mujahidin and a film crew, as communist troops on the other side of the ridge were pounding the position with mortar bombs.

On seeing me again as I pulled up at his trenches, the tall Arab screamed at me. The next thing I knew, Arabs and Afghans—both supposedly fighting on the same side against the communists—had raised their guns at each other. One of the Arab militants cocked his AK-47, thrusting it into the back of the cameraman. “We will kill you. We will kill you all,” he shrieked. At this point the Afghan commander I was with intervened, pleading that such anger was not good for Islam. Cautiously, we pulled back. It was several years before I learned that the tall man who threatened to kill me was Osama bin Laden.

Many of the non-Afghan Muslims, including the ones supporting bin Laden, committed atrocities against pro-communist prisoners and civilians, documented by Human Rights Watch and other similar groups, that shocked even the most battle-hardened Afghans. “You don’t slit people’s throats, you shoot them,” one Pashtun commander told me in Konar Province in 1989 after I visited a mass grave of executed prisoners. Clasped hands and other body parts, mummified by the sun, still protruded from the ground. The Islamic militant fighters also deliberately fired on Western journalists and aid workers, including clearly marked vehicles of the International Red Cross, daring to operate inside their zones.

Across the border in Pakistan, Islamic groups



The ten-year war with the Soviet Union killed more than a million Afghans and forced another six million to flee the country. Drought and war have since displaced even more people. The UN anticipates feeding 7.5 million Afghans this winter.

sought to influence the more than three million Afghan refugees who had fled there during the Soviet war. (Nearly three million refugees went to Iran.) Their attention was particularly aimed at young men and boys, many of whom had spent their whole lives in refugee camps. The militants built *madrasahs* (Koranic schools) and mosques in the camps as their contribution to the furthering of a purist Islam. Such *madrasahs* provided the means to churn out young, partly educated *taliban* (students of religion) who had never known Afghanistan as

invisible threat to fleeing refugees and to farmers trying to scratch a living in this parched land.) I was walking ahead of the medical convoy with a group of mujahidin, and we halted to let the bulk of the horses catch up. One young man strolled off to gather firewood so we could brew some tea. There was a loud explosion. My first thought was a grenade or rocket, but then I saw the young Afghan, barely 20 yards away, crawling along the ground. He had stepped on a Soviet antipersonnel mine. His mangled foot was amputated on the spot

AFGHANISTAN is “one of the most difficult places in the world to survive,” one UN official said.

a country and whose vision of the future was based on a perverse interpretation of the Koran mixed with anti-Western sentiment. Western aid workers, primarily women, in the frontier town of Peshawar were often assaulted by the extremists, verbally and physically.

In September Shuaib and I began our trip to Afghanistan by taking the twice-weekly UN plane from Islamabad to Feyzabad over the 25,000-foot-high Hindu Kush range that stretches across northern and central Afghanistan. Years earlier, during the Soviet war, I had traveled secretly by foot with Shuaib across many of the precipitous mountain passes we could now see leading from Pakistan into the Afghan interior. With our gear loaded onto mules and horses, we had walked by day and by night, covering hundreds of miles.

Now, map in hand, we gazed down on some of the formidable land routes and passes—former caravan and mule trails dating back to the time of Alexander the Great—that we had trekked years earlier. For security, but also because it allowed me to meet local people more readily, I had often accompanied French medical teams, who came to work in the mountains for six to nine months at a time. Sometimes their relief caravans consisted of 150 or more horses, transporting food and medical supplies for their clinics.

On one of those trips, in 1981, I had my first encounter with a land mine. (Millions of mines still litter Afghanistan, presenting a fateful,

by the French doctors, and he was dispatched back to Pakistan for medical care.

At another point in the flight Shuaib and I could distinguish the Chamar Pass, where in the mid-1980s we had witnessed Soviet aircraft deliberately bomb a clearly identifiable column of refugees, killing and wounding perhaps a hundred men, women and children. And then, just north of Kabul, I glimpsed the Panjshir Valley with its long patchwork of irrigated fields and villages, laced by narrow side valleys through which, on one occasion, I had to flee fast-moving Soviet troops.

Somehow, however, I couldn't seem to re-discover, either in my mind or in the landscape below, that first feeling of awe I had experienced in 1981 on finally reaching—after a long morning's climb—the windy col of the 15,000-foot-high Diwana Baba (Crazy Old Man) pass. On that day I had found myself utterly overwhelmed by the sea of vaulting mountains and clouds that stretched out before me. So this is Afghanistan, I remember thinking.

Today I could only behold this massive and craggy landscape in bleak contemplation. The drought had clearly taken its toll. All the once daunting snowfields appeared to have dwindled to patches of dirty ice staining huge expanses of rockfall and moraine. Even the once vividly green alpine pastures emerged as little more than dusty brushworks of brown. While I could still see clusters of glistening lakes with small streams and rivers trickling their way down into the valleys, many others were dry.

Once on the ground at Liwa Camp, a former army camp on the outskirts of Feyzabad overlooking the churning Kowkchek River, I spoke with Mohammad Siddiq, a middle-aged man of quiet dignity and pride from Takhar Province, 75 miles away. It was the same tragic scene I'd witnessed countless times before throughout the refugee camps of Pakistan's North-West Frontier Province and inside Afghanistan itself. Together with some 2,000 men, women, and children, Siddiq had fled because of the aerial bombardments last year in which he lost his 15-year-old son. "We left everything behind," he explained. "People brought only their donkeys for transport but not their cattle or sheep." He gestured to the makeshift shelters covered with blue plastic. "We've already spent one winter in those and have enough food for a few more weeks. Do you think there will be more coming?"

It was not a plea but simply a query about what might happen to him and his family, who like so many others were facing the very real prospect of starvation. I wished that I could provide him with some hope. But even before mid-September, when international aid organizations temporarily left in the wake of the attacks on New York and Washington, all the efforts of the World Food Program—the UN's principal distribution agency—had still left Afghanistan with a food deficit of a million tons. Even before mid-September poverty, hunger, displacement, insufficient health care, and the abuse of civilians had made this already devastated country "one of the most difficult places in the world to survive," as one UN official put it to me. Of the country's perhaps 25 million people, almost four million, many of them widows and orphaned children, were relying on food handouts to live. A nearly equal number were considered vulnerable and in need of some form of outside assistance.

Some of Afghanistan's displaced people are fortunate enough to have been taken in by host families. This was evident when Shuaib and I arrived late at night at his home in Keshem, a small town less than two hours from the Taliban frontlines. Among those there to greet us were two refugee families who had fled the fighting last year and were living

in Shuaib's home. For the next two days—as friends and relatives stopped by to greet us—Shuaib's family prepared huge meals of rice, mutton, chicken, okra, potatoes, grapes, and melon followed by innumerable cups of green tea for all who came, sometimes 30 at a time. Such displays are exceptionally rare these days, even for local notables such as Shuaib's family. But the scenes of plenty in a land of scarcity didn't surprise me, because Afghans will often spend their last penny to ensure that guests are well cared for.

In fact, in more than 20 years of traveling in Afghanistan, I have often found myself invited to share food with people who could ill afford it.

TAKING POWER in 1996, the Taliban quickly forbade women from working and from leaving home unescorted or uncovered. Girls no longer attend school, and boys often get no education either; most teachers in Afghanistan were women. Almost 70 percent of Afghans are illiterate.



MICHAEL YAMASHITA

These people known as fierce fighters, especially in the face of foreign invasion, are also unfailingly warm and generous to guests—one reason why so many journalists, aid workers, and travelers have returned to this country again and again. The mere fact that the Taliban made rules forbidding foreigners to visit Afghans in their homes illustrates to what degree the regime removed itself from the essence of Afghan society, for welcoming strangers seems to be part of the Afghan soul. Yet knowing what Afghans have gone through since 1978, I find myself wondering what more they can endure, and whether I—or any other outsider—will encounter such bountiful scenes of generosity ever again. □

MORE ON OUR WEBSITE

Find map updates and an interview with former resistance fighter Mohammad Shuaib at nationalgeographic.com/ngm/0112.
AOL Keyword: NatGeoMag

ON ASSI

ON THE ROAD, IN THE FIELD,

ANTARCTICA

View From the Top

*Taking a cold, clear-eyed
look at a frozen world*



GNMMENT

C O V E R I N G T H E W O R L D

Aiming high, photographer **Maria Stenzel** (left) surveys the Antarctic horizon from atop the mast of the *Golden Fleece*, which she and author **Roff Smith** (right, in front of skipper Jérôme Poncet) chartered for a five-week exploration of the frozen continent. “They tie you into a bosun’s chair and haul you up there,” recalls Maria, who was on her third assignment to Antarctica. “I’m comfortable with heights,” she says. “The longer I spent up there, the more comfortable I was.”

Roff, too, reached new heights in Antarctica. When he told geologists that he’d seen a variety of figures for the elevation of Mount Erebus, one scientist suggested that Roff assist in a measurement effort using



ROFF SMITH (OPPOSITE PAGE, BOTH); MARIA STENZEL

advanced global positioning system technology. So Roff and three companions climbed the peak in 20° below zero F weather

to help obtain a more accurate reading. Their conclusion: Mount Erebus rises 12,344 feet above sea level.

WORLDWIDE

“It was like being in a science fiction movie,” **Bob Sacha** (below, at center) says of his photographic visit to a “clean room” at Intel’s Silicon Valley chip-manufacturing facility. Like the plant’s workers, including technician Fawad Ahmed, at left, Bob donned a “bunny suit” and sterile cap designed to keep dust out of the precious chips. “I have to adapt



BOB SACHA

to whatever situation I’m in,” Bob explains. “If someone says put on these clothes, I put on the clothes. It makes you understand how the workers there feel.”

Author **Cathy Newman** calls herself “a Luddite at heart,” which is why she felt somewhat out of place in Silicon Valley. “I felt so East Coast, so old, so un-rich, and so un-blond,” she says. “Here I am taking notes with a pen and notepad—how un-cool!—and everyone else within a hundred-mile radius is on their cell phone or Palm Pilot.”

Photographer **Reza** traveled throughout the Middle East to retrace the footsteps of Abraham, including

a helicopter flight over Mecca during the hajj, the annual Muslim pilgrimage. But the project soon became more than just a story to him. “It was like traveling inside myself,” says the Iranian-born, Muslim photographer, who now lives in Paris. “It was spiritual travel, questioning everything in my education and my religion.” On that inner journey he came to believe that the seemingly eternal conflict in the Middle East can be stopped “if we all understand who Abraham was and what his message was. He was the father of us all—and a man of peace.”

MORE ON OUR WEBSITE

Find more stories about life on assignment from our authors and photographers, including their best and worst experiences, at nationalgeographic.com/ngm/0112. AOL Keyword: NatGeoMag

I N M E M O R I A M



Tragedy Strikes Close to Home

They died doing the jobs they loved, jobs they did enthusiastically and well. Ann Judge (right), director of our travel office, and Joe Ferguson (bottom), with our geography education outreach program, were killed September 11 when their hijacked plane crashed into the Pentagon. They were escorting three Washington, D.C., students and three teachers (above, shortly before their flight) on a Society-sponsored educational trip to California. "Ann and Joe were going to make geography and the environment come alive for these committed, talented teachers and their star students by putting them into the field," said John Fahey, the Society's President. Ann had been with us for 22 years; Joe for 14. Our hearts grieve for them and for those promising young students and their dedicated teachers.

(From left) Teacher James D. Debeuneure and Rodney Dickens, Ketcham Elementary School; Bernard Brown and teacher Hilda E. Taylor, Leckie Elementary School; Asia Cottom and teacher Sarah M. Clark, Backus Middle School; Joe Ferguson; Ann Judge.



GWEN FAULKNER (TOP); ADAM BUCHANAN (ANN JUDGE IN ITALY); ROBERT GARRETT (JOE FERGUSON IN ALASKA)

For people with type 2 diabetes

“Taking care of my diabetes takes real commitment. Always.”



“I do want to be stronger than diabetes. I want to do this for myself, and for Eileen — my wife and best friend.

“So, I will always take care of myself. It was tough at first, but I got into a good diet and exercise routine. That still wasn't enough, so my doctor added *Avandia* for my type 2 diabetes. It helps my body use its own natural insulin more effectively.

“It's been a year now, and I've kept my blood sugar down — with the help of *Avandia*. Your results may vary.”

Avandia, along with diet and exercise, helps improve blood sugar control. It may be prescribed alone, with Glucophage® (metformin HCl tablets), or with sulfonylureas. When taking *Avandia* with a sulfonylurea, you may be at risk for low blood sugar. Ask your doctor whether you need to lower your sulfonylurea dosage.

Some people may experience tiredness, weight gain or swelling with *Avandia*.

Avandia in combination with insulin may increase the risk of serious heart problems. Because of this, talk to your doctor before using *Avandia* and insulin together. *Avandia* may cause fluid retention, or swelling, which could lead to or worsen heart failure, so tell your doctor if you have a history of these conditions. If you experience an unusually rapid increase in weight, swelling or shortness of breath while taking *Avandia*, talk to your doctor immediately. *Avandia* is not for everyone. If you have severe heart failure or active liver disease, *Avandia* is not recommended.

Also, blood tests to check for serious liver problems should be conducted before and during *Avandia* therapy. Tell your doctor if you have liver disease, or if you experience unexplained tiredness, stomach problems, dark urine or yellowing of the skin while taking *Avandia*. See important patient information on the following page.

Talk to your doctor, or for more information call 1-800-AVANDIA (1-800-282-6342) or visit www.avandia.com

Strengthen your body's own ability to help control blood sugar.

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 **Avandia**®
rosiglitazone maleate

You can be stronger than diabetes

Patient Information about AVANDIA® (rosiglitazone maleate) 2 mg, 4 mg, and 8 mg Tablets

What is *Avandia*?

Avandia is one product in a class of prescription drugs called thiazolidinediones (thigh-a-zol-a-deen-die-owns) or TZDs. It is used to treat type 2 diabetes by helping the body use the insulin that it is already making. *Avandia* comes as pills that can be taken either once a day or twice a day to help improve blood sugar levels.

How does *Avandia* treat type 2 diabetes?

If you have type 2 diabetes, your body probably still produces insulin but it is not able to use the insulin efficiently. Insulin is needed to allow sugar to be carried from the bloodstream into many cells of the body for energy. If insulin is not being used correctly, sugar does not enter the cells very well and builds up in the blood. If not controlled, the high blood sugar level can lead to serious medical problems, including kidney damage, blindness and amputation.

Avandia helps your body use insulin by making the cells more sensitive to insulin so that the sugar can enter the cell.

How quickly will *Avandia* begin to work?

Avandia begins to reduce blood sugar levels within 2 weeks. However, since *Avandia* works to address an important underlying cause of type 2 diabetes, insulin resistance, it may take 8 to 12 weeks to see the full effect. If you do not respond adequately to your starting dose of *Avandia*, your physician may increase your daily dose to improve your blood sugar control.

How should I take *Avandia*?

Your doctor may tell you to take *Avandia* once a day or twice a day (in the morning and evening). It can be taken with or without meals. Food does not affect how *Avandia* works. To help you remember to take *Avandia*, you may want to take it at the same time every day.

What if I miss a dose?

If your doctor has prescribed *Avandia* for use once a day:

- As soon as you remember your missed dose, take one tablet anytime during the day.
- If you forget and go a whole day without taking a dose, don't try to make it up by adding another dose on the following day. Forget about the missed dose and simply follow your normal schedule.

If your doctor has prescribed *Avandia* for use twice a day:

- As soon as you remember the missed dose, take one tablet.
- Take the next dose at the normal time on the same day.
- Don't try to make up a missed dose from the day before.
- You should never take three doses on any single day in order to make up for a missed dose the day before.

Do I need to test my blood for sugar while using *Avandia*?

Yes, you should follow your doctor's instructions about your at-home testing schedule.

Does *Avandia* cure type 2 diabetes?

Currently there is no cure for diabetes. The only way to avoid the effects of the disease is to maintain good blood sugar control by following your doctor's advice for diet, exercise, weight control, and medication. *Avandia*, alone or in combination with other antidiabetic drugs (i.e., sulfonylureas or metformin), may improve these other efforts by helping your body make better use of the insulin it already produces.

Can I take *Avandia* with other medications?

Avandia has been taken safely by people using other medications, including other antidiabetic medications, birth control pills, warfarin (a blood thinner), Zantac® (ranitidine, an antiulcer product from GlaxoSmithKline), certain heart medications, and some cholesterol-lowering products. You should discuss with your doctor the most appropriate plan for you. If you are taking prescription or over-the-counter products for your diabetes or for conditions other than diabetes, be sure to tell your doctor. Sometimes a patient who is taking two antidiabetic medications each day can become irritable, lightheaded or excessively tired. Tell your doctor if this occurs; your blood sugar levels may be dropping too low, and the dose of your medication may need to be reduced.

What should I discuss with my doctor before taking *Avandia*?

Avandia in combination with insulin may increase the risk of serious heart problems. Because of this, talk to your doctor before using *Avandia* and insulin together. *Avandia* may cause fluid retention or swelling which could lead to or worsen heart failure, so tell your doctor if you have a history of these conditions. You should also talk to your doctor if you have liver problems, or if you are nursing, pregnant or thinking of becoming pregnant. If you are a premenopausal woman who is not ovulating, you should know that *Avandia* therapy may result in the resumption of ovulation, which may increase your chances of becoming pregnant. Therefore, you may need to consider birth control options.

What are the possible side effects of *Avandia*?

Avandia was generally well tolerated in clinical trials. The most common side effects reported by people taking *Avandia* were upper respiratory infection (cold-like symptoms) and headache. As with most other diabetes medications, you may experience an increase in weight. You may also experience edema (swelling) and/or anemia (tiredness). If you experience any swelling of your extremities (e.g., legs, ankles) or tiredness, notify your doctor. Talk to your doctor immediately if you experience edema, shortness of breath, an unusually rapid increase in weight, or other symptoms of heart failure.

Who should not use *Avandia*?

You should not take *Avandia* if you are in the later stages of heart failure or if you have active liver disease. The following people should also not take *Avandia*: People with type 1 diabetes, people who experienced yellowing of the skin with Rezulin® (troglitazone, Parke-Davis), people who are allergic to *Avandia* or any of its components and people with diabetic ketoacidosis.

Why are laboratory tests recommended?

Your doctor may conduct blood tests to measure your blood sugar control. Blood tests to check for serious liver problems should be conducted before starting *Avandia*, every 2 months during the first year, and periodically thereafter.

It is important that you call your doctor immediately if you experience unexplained symptoms of nausea, vomiting, stomach pain, tiredness, anorexia, dark urine, or yellowing of the skin.

How should I store *Avandia*?

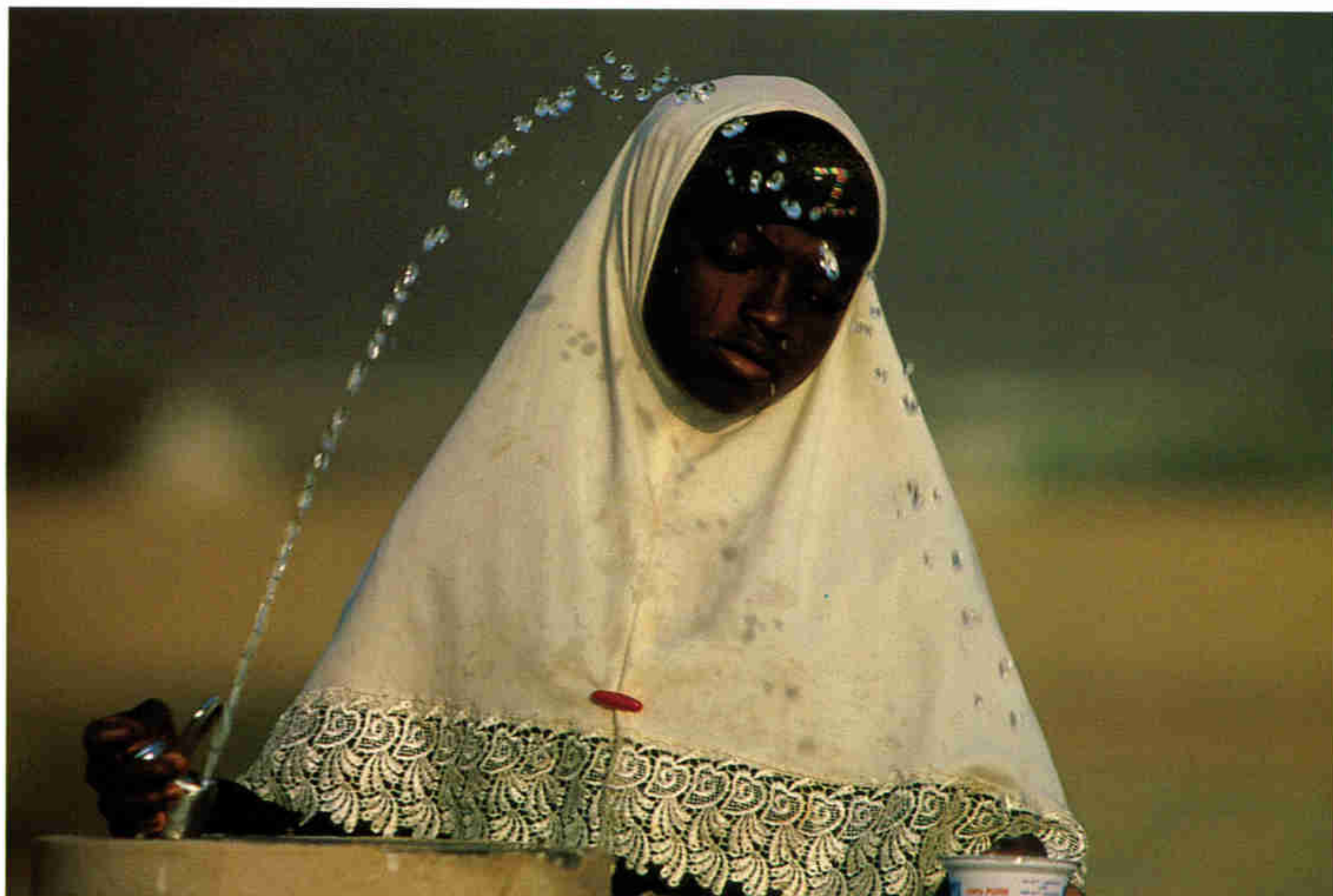
Avandia should be stored at room temperature in a child-proof container out of the reach of children. Store *Avandia* in its original container.



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Final Edit



REZA

ABRAHAM: JOURNEY OF FAITH

Savoring the Moment

A young Muslim woman quenches her thirst during the hajj, a pilgrimage to Mecca—and calls to mind a story sacred to Jews, Christians, and Muslims: Stranded in the wilderness and dying of thirst, Abraham's son Ishmael and his mother, Hagar, are guided by God to a life-sustaining well of water. "This image evokes that narrative," says illustrations editor Todd James. "But the frame first appealed to me because of its sheer beauty." The serenity of the scene, the contrasting colors, the glistening arc of water droplets all help make this photo a keeper. "Pictures like this one reflect the true power of still photography," says James. "A great picture separates a poetic moment from the rest of life and preserves it. We can hold it in our hands and in our minds, turn it over and over—and savor it."

MORE ON OUR WEBSITE

Find out why this picture didn't make it into the story at nationalgeographic.com/ngm/0112.

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Antarctica: Dress Warmly



MARIA STENZEL

Head south with photographer Maria Stenzel on her multi-media tour of Antarctica's icy splendor. Exalt in panoramic

views of the South Pole, penguin nesting grounds, and Mount Erebus (above), a fumarole-studded volcano

towering 2.5 miles above the Ross Sea. Discover what draws the world's scientists at nationalgeographic.com/ngm/0112.



Useful Tools

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DAVID DOUBILET

Pearl Harbor Firsthand Accounts

On the 60th anniversary of the bombing of Pearl Harbor, add your memories to our online Web special. Attractions include an interactive battle map and a memory book, a collection of stories from survivors and their families. See this moving Web special for yourself at nationalgeographic.com/pearlharbor.



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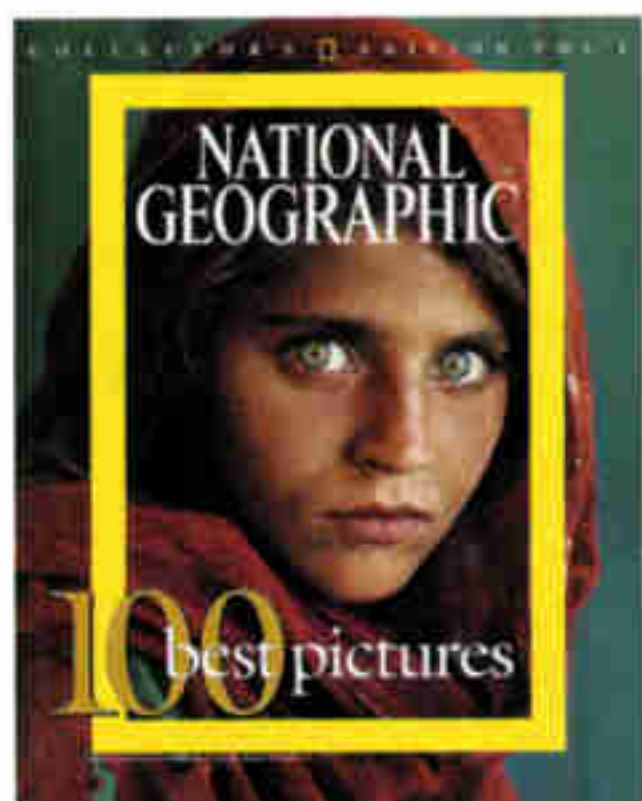
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Best of 2001

Fiery Stromboli lures scientists to Italy's Aeolian Islands to study one of Earth's most active volcanoes. Their fearless work is documented in *Volcano Hunters*, one of the exciting films sampled in *Best of Explorer 2001*. The show savors a year's worth of unforgettable footage, from the raising of a Confederate submarine to a trek through the wildest regions of Africa.

NATIONAL GEOGRAPHIC
CHANNEL, DECEMBER 9

Teaming Up On SuperCroc

To reconstruct the skeleton of a massive 40-foot-long prehistoric crocodilian that he unearthed in the Sahara, paleontologist Paul Sereno decided to do his homework on some of the largest living crocs. Teaming with National Geographic's reptile expert, Brady Barr (right, at right), Sereno takes a close look at the long-snouted gharial in India. *SuperCroc*, a film premiere, follows the global quest to bring a monstrous fossil back to life.

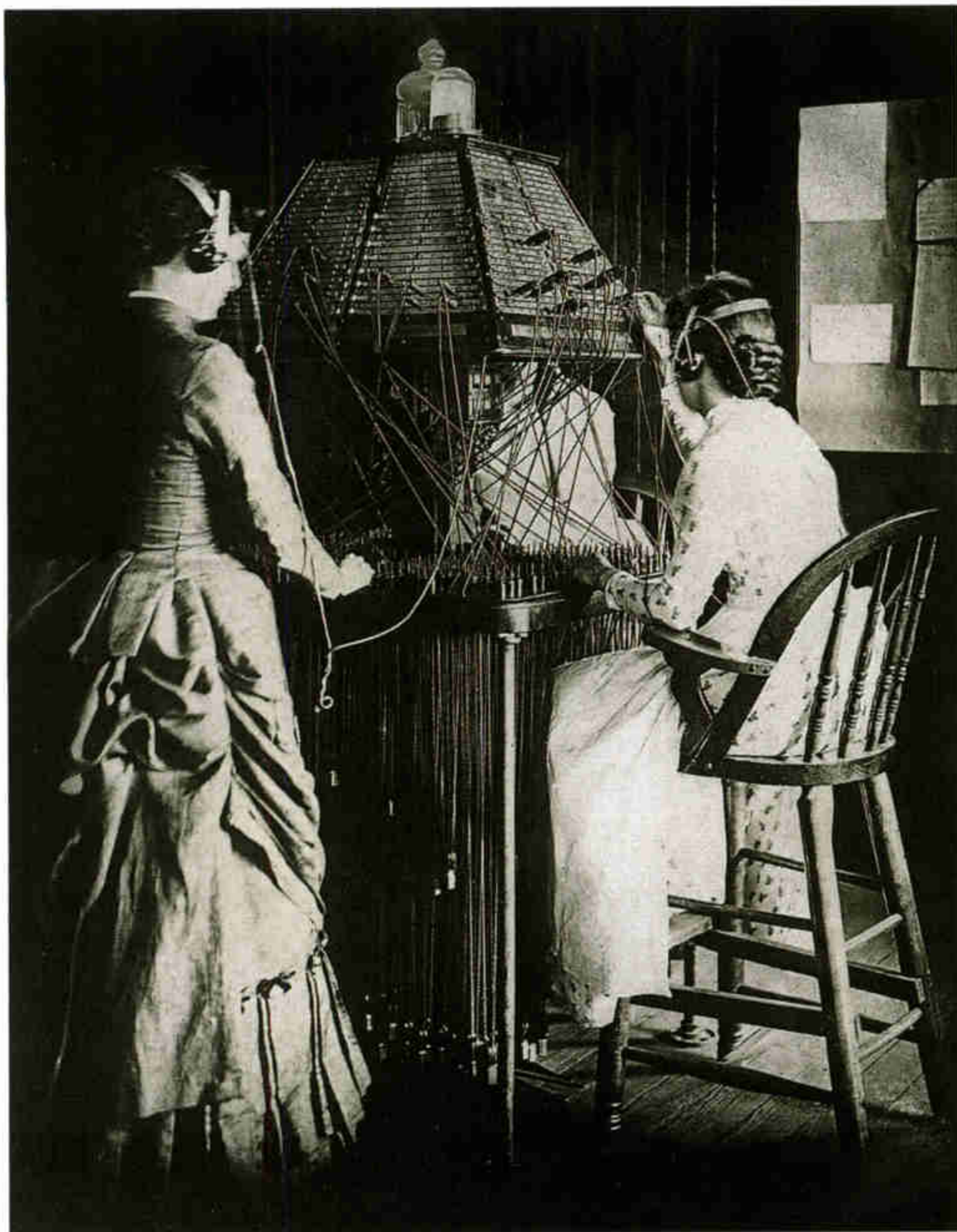


LARRY MITCHELL (TOP); BRADY BARR

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Flashback



KEYSTONE

THE FUTURE IS CALLING

Smooth Operators

“The telephone companies early found that women were temperamentally far better suited to be operators than the boys,” wrote F. Barrows Colton. His article “The Miracle of Talking by Telephone” appeared in the October 1937 *GEOGRAPHIC*, where this early 1880s photograph of a Richmond, Virginia, switchboard was published. Male operators, according to the caption, “‘talked back’ to customers and were otherwise unsatisfactory, so girls soon replaced them.” The women, wrote Colton, were “an instant success . . . they paved the way for women to enter many other fields of employment.”

MORE ON OUR WEBSITE

You can send this month's Flashback as an electronic greeting card and access the Flashback photo archives at nationalgeographic.com/ngm/flashback/0112.



Biotechnology
researchers call it
“golden” rice.

For the color.
For the opportunity.

“When mothers and their children eat an adequate amount of vitamin A in a daily meal, it could help alleviate more suffering and illness than any single medicine has done.”

The excitement expressed by plant biologist Charles Arntzen reflects the golden opportunity that many see in a new strain of rice being developed with biotechnology. “Golden” rice contains increased amounts of beta-carotene, a source of vitamin A. Because rice is a crop eaten by almost half the world, golden rice could help relieve a global vitamin A deficiency that now causes blindness and infection in millions of the world’s children.

Discoveries in biotechnology, from medicine to agriculture, are helping doctors treat our sick, farmers protect our crops – and could help mothers nourish our children, and keep them healthier. To learn more about biotechnology and agriculture, visit our Web site or call us.

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ROCKS AND DOWN THE CANYON
AND INTO THE GORGE AND UP THE
MOUNTAIN AND UNDER THE CLIFF
AND BETWEEN THE BOULDERS AND
PAST THE SWITCHBACKS AND INTO
THE STREAM AND BEYOND THE RIDGES
TO GRANDMOTHER'S HOUSE WE GO.